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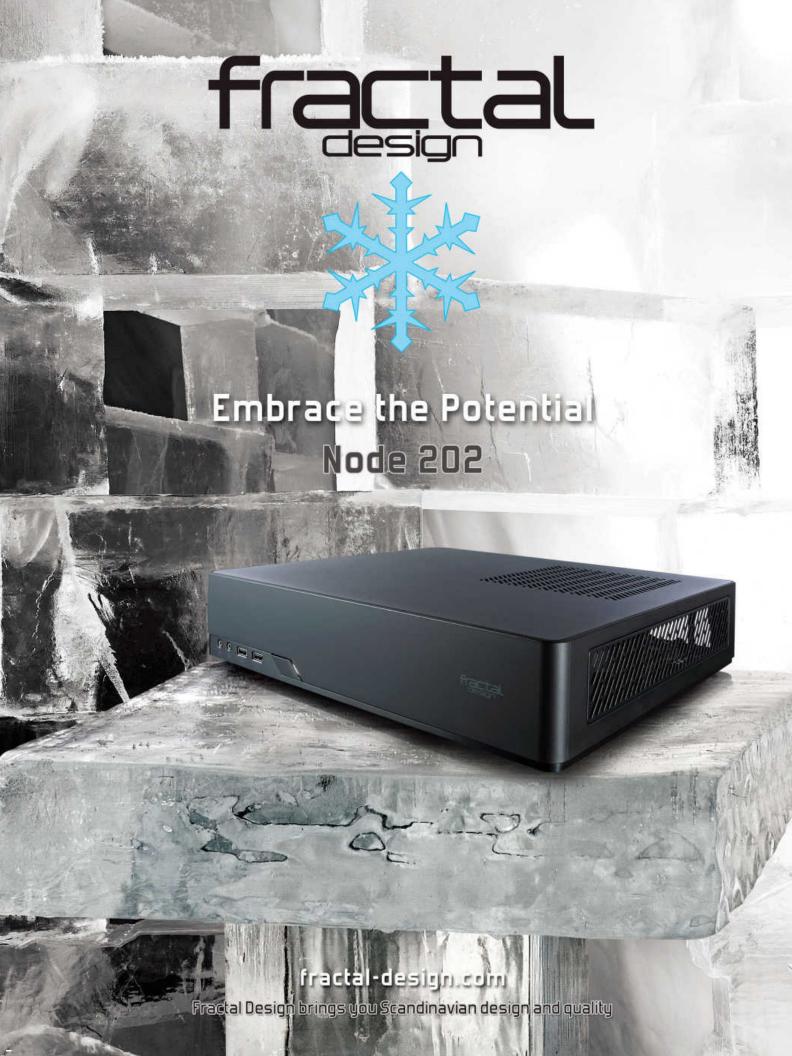
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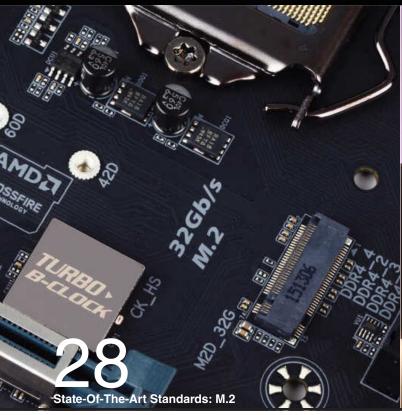
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Monthly last-page interview with people who help to shape the PC industry.

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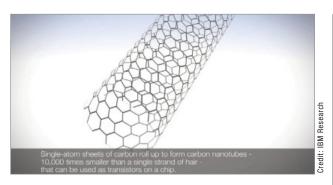
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IBM Breakthrough Could Affect Four Or More Generations Of Transistors

IBM has been experimenting for some time with carbon nanotubes, rolled sheets of carbon just one atom thick. The nanotubes have electrical properties that are better than silicon, but until now have been stymied by a problem that vexes nanotube and silicon technologies alike: how to overcome increasing electrical resistance at atomic-scale sizes for the contacts inside a chip. IBM says its researchers have solved the problem by creating a new metallurgical process that can be compared to welding at the microscopic level. The new process chemically binds the atoms at the ends of carbon nanotubes to the metal atoms in a chip. The company says this allows the contacts to be downsized without affecting their electrical performance, potentially all the way to 1.8 nanometers, which represents another four generations of chip technology manufacturing.

GIGABYTE Announces GTX980 WATERFORCE With Liquid Cooling

GIGABYTE has announced another graphics card based on NVIDIA's GeForce GTX980 GPU. Unlike other single-card models already in GIGABYTE's lineup, the new GTX980 card is liquid-cooled. The GeForce GTX980 WATERFORCE includes GIGABYTE's all-in-one liquidcooling setup, which has an integrated low-noise pump and 120mm silent fan for quiet operation. WATERFORCE uses a full-cover water block, so it cools the card's GPU and VRAM as well as the MOSFET. GIGABYTE also has incorporated GPU Gauntlet Sorting in the manufacturing of this card. This is GIGABYTE's way of prebinning the GPUs to ensure the ones with the fastest cores will be used in the GTX980 WATERFORCE. Overclockers who want to push their systems to the limit should find plenty of headroom with the GPUs used in the GTX980 WATERFORCE.



WATCHING THE CHIPS FALL

Introduction of the					
Hana ta Maa matata a	СРИ	Released	Original Price	Last Month's Price	Online Retail Price*
Here is the pricing	AMD FX-9590 Eight-Core	6/11/2013	N/A	\$239.99	\$239.99
information for	AMD FX-9370 Eight-Core	6/11/2013	\$375	\$209.99	\$209.99
various AMD and	AMD FX-8350 Eight-Core	10/23/2012	\$195	\$169.99	\$169.99
Intel CPUs.	AMD FX-8320 Eight-Core	10/23/2012	\$169	\$149.99	\$144.99
IIILEI GFUS.	AMD FX-6350 Six-Core	4/30/2013	\$132	\$126.49	\$125.95
	AMD A10-7850K Quad-Core	1/14/2014	\$173	\$129.99	\$129.99
	AMD A10-7800 Quad-Core	7/2/2014	\$153	\$126.99	\$129.99
	AMD A10-7700K Quad-Core	1/14/2014	\$152	\$121.99	\$119.99
	AMD A10-6800K Quad-Core	6/4/2013	\$142**	\$143.49	\$129.49
	AMD A10-5800K Quad-Core	10/2/2012	\$122**	\$89.99	\$89.99
	Intel Core i7- 5960X Eight-Core	8/29/2014	\$999**	\$1,049.99	\$1,049.99
	Intel Core i7- 4960X Six-Core	9/3/2013	\$990**	\$1,029.99	\$1,024.99
	Intel Core i7- 5930K Six-Core	8/29/2014	\$583**	\$584.99	\$584.99
	Intel Core i7- 4930K Six-Core	9/3/2013	\$583**	\$604.99	\$599.99
	Intel Core i7- 5820K Six-Core	8/29/2014	\$389**	\$389.99	\$389.99
	Intel Core i7-6700K Quad-Core (Skylake)	8/5/2015	\$359**	\$369.99	\$369.99
* As of October 2015	Intel Core i7-4790K Quad-Core	6/25/2014	\$339**	\$339.99	\$339.99
** Manufacturer's	Intel Core i7-4820K Quad-Core	9/3/2013	\$323**	\$329.99	\$329.99
estimated price	Intel Core i7-4790 Quad-Core	5/11/2014	\$303**	\$309.99	\$309.99
per 1,000	Intel Core i5-6600K Quad-Core (Skylake)	8/5/2015	\$249**	\$249.99	\$269.99

Corsair Says STRAFE RGB Silent Is Up To 30% Quieter Than Others

Corsair's new STRAFE RGB Silent is the first mechanical keyboard on the market that uses Cherry MX Silent keyswitches. The new switches have a patented noisereduction technology that Corsair says makes the STRAFE RGB Silent up to 30% more quiet during operation than other keyboards. The keys are fully programmable, so gamers can set up macros and assign specific game functions. You also can add all kinds of special backlighting effects thanks to the onboard controller and Cherry MX RGB lighting. MSRP for the STRAFE RGB Silent is \$159.95.



ASRock's Fast New G10 Gaming Router Incorporates IoT Controls

ASRock says its new G10 Gaming Router is the world's fastest 4T4R (four transmitter, four receiver) 802.11ac router, using eight antennas hidden inside the tower case to push 5G data at 1,733Mbps and 2.4G data at 800Mbps. The G10 is meant for gaming, but ASRock incorporated IR technology into the router so that it can receive and "learn" the codes used by other products in the house, including IoT devices. You can then control those devices via ASRock's Router app you can download to your smartphone or other mobile device.



FRONTSIDE WHAT'S HAPPENING HARDWARE

ASUS ROG Maximus VIII Impact Loaded With High-End Features

The ROG Maximus VIII Impact is for Skylake Mini-ITX systems, but ASUS says the features on the board give it the same OC and performance capabilities as high-end ATX boards. The motherboard has a completely digital power architecture called Impact Power III, combined with 5-way optimization and Pro Clock technology. These features make it easy for users to adjust power settings and voltages and tweak base clocks and other settings. Audio and networking features also are top-of-the-line. You can find the ROG Maximus VIII Impact at retail for about \$250.



FRONTSIDE WHAT'S HAPPENING HARDWARE

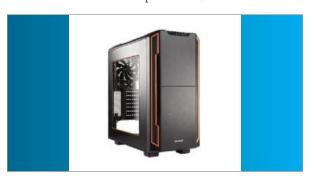
Microsoft Enters Notebook Market Fray With Surface Book

Microsoft is now taking pre-orders for the Surface Book, a notebook computer that comes with a fully detachable screen so, yes, it can look and act like a tablet. But it also can be ordered with the latest sixth-generation Intel Core processors, and the keyboard holds a discrete NVIDIA GPU and extra battery storage. The Surface Book has a magnesium case and a 13.5-inch touchscreen display with 3,000 x 2,000 resolution, and it weighs just 3.34 pounds with the keyboard. SSD storage options range up to 1TB. The price for Microsoft's first notebook starts at \$1,499.



be quiet! Announces Silent Base 600 Chassis Series Now Available

The Silent Base 600 case is made mostly of 0.7mm steel and is designed to maximize airflow and reduce noise. The sides and front of the case are insulated, and it comes with two of be quiet!'s Pure Wings 2 fans already installed. A three-step fan controller and easy-to-clean air filters are also integrated in the case. There is plenty of room for routing cables, and grommets and passthroughs are strategically placed so that you can avoid air blockages with cabling. The case comes in three color schemes: black, orange, and silver. The version of the case with a window side panel runs \$119.90.



EK Water Blocks Releases First Product In New X4 Reservoir Series

EKWB has a new series of liquid-cooling reservoirs called X4. Its first release in the series is the EK-RES X4 250. The body of the reservoir is a glass cylinder, and both ends have black caps made of POM Acetal. The bottom cap holds a white LED strip to illuminate liquid. Both caps have inset metal nut holders that allow the reservoir to be mounted in different positions inside a case. A fan holder and universal holder are included for mounting; both are made of nickel-plated wire. With caps, the unit measures 250mm tall. It retails for \$154.99.



FRONTSIDE
WHAT'S HAPPENING
HARDWARE

COUGAR Announces New 700M eSports Gaming Mouse

COUGAR has added another product to its 700M series of gaming mice. The 700M eSports Gaming Mouse offers many of the same features as the rest of its mousing kin (eight programmable buttons; adjustable weights; 8,200dpi laser sensor, 1,000Hz polling rate) but comes with a new coating that COUGAR says improves the tactile feel. The mouse also comes in two special white and red color schemes. COUGAR says the 700M eSports Gaming Mouse is a limited-edition product for serious gamers; other mice in the 700M series run about \$60, so expect to pay a little extra.



FRONTSIDE
WHAT'S HAPPENING
HARDWARE

MSI Announces DS502 7.1 Surround Sound Gaming Headset

MSI has announced a new gaming headset with enhanced virtual surround sound. The DS502 7.1 Gaming Headset has 40mm drivers and comes with Cmedia Xear software. The Xear software package has numerous gaming presets and a 10-band equalizer and lets you save preferred settings. You also can add vibrations to your gaming. The headset has a frequency response from 20Hz to 20kHz and includes noise-canceling. It comes with a two-meter braided cable and adjustable boom mic, and the cans have an MSI GAMING dragon logo that lights up.



FinalWire Updates AIDA64 System Information Software

When you're trying to garner more information about your system—detailed info about hardware and software, help diagnosing problems, and a way to benchmark performance—a tool such as FinalWire AIDA64 can help. AIDA64 Extreme, the \$39.95 version for PC enthusiasts, includes that functionality along with support for overclocking and the ability to gather accurate voltage, temperature, and fan speed readings. The newest version also includes drive autodetect, temperature measurement, and SMART disk health status detection. Plus, the tool has 64bit benchmarks and supports the latest hardware technologies.



Ashampoo Makes Photo Editing Easier With Updated Package

Ashampoo, which publishes dozens of software apps and utilities, has updated its \$59.99 Photo Commander image editing package. Photo Commander Version 14 includes new features aimed at making photo editing easier even for less experienced photographers. There's enhanced support for the RAW image file format and updated editing tools that let you cut out multiple objects at once. Photo bombed? Cut out the offending person(s) with a few clicks. You can adjust image perspectives and combine mirror effects and perspectives in your final image. There's also a new scan wizard and photo import tools.



FRONTSIDE WHAT'S HAPPENING

Basemark Plans To Release Utility For Benchmarking PC Games

Basemark, the Finland-based maker of benchmarking utilities used by mobile device manufacturers, is expanding into the computer gaming arena. Basemark is partnering with diagnostic software company HWiNFO and plans to build what it calls the "world's largest and most accurate PC performance database" called Power Board. Basemark intends to use HWiNFO's extensive information on PC components to help it recognize and identify the parts on computer systems that are using its benchmarking tools. This will allow computer gamers to better compare game performance results across systems.



WHAT'S HAPPENING

Adblock Plus Is First Free Ad Blocker App For iOS

In addition to offering its own mobile Adblock Browser, Adblock Plus now has an app for automatically blocking annoying ads on the Safari browser. With either option, you'll benefit from less data usage, faster page downloads, security from malvertising, better privacy, and longer battery life. After you activate the app's content-blocking features, when you click any URL, the Safari browser will open without ads. You can whitelist specific sites to support ads, change default settings to block all ads, disable tracking and social media buttons, and add additional filters based on your site viewing preferences.



Report: Mobile Browser Traffic Two Times Greater Than App Traffic

Mobile apps are a huge market, but a new report from Morgan Stanley shows that mobile browser traffic (which it defines as unique visitors) is as much as two times larger and growing 1.2 times faster. Since 2013, the study found that browser audiences have grown 61% a year, while app audiences have grown about 51% a year. Of the top 50 mobile sites in the United States, just 12 have larger app audiences. Six of those 12 properties are what Morgan Stanley calls "daily habits" such as email, search, and checking the weather. The other six are social sharing or streaming media sites.



Registry Runs Out Of IPv4 Addresses

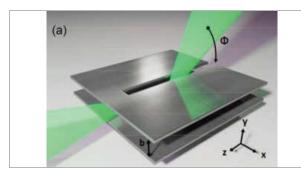
It's official: After years of warnings that we would run out of IPv4 addresses and need to move to or at least have a plan for IPv6, ARIN (the American Registry for Internet Numbers) has exhausted its IPv4 free pool. ARIN will continue to process and approve requests for IPv4 address blocks, but approved requests will be filled via the Wait List for Unmet IPv4 Requests or through the IPv4 Transfer Market. Because ARIN has run out of IPv4 addresses, there are no longer restrictions on how often organizations can request transfers to specified recipients, according to ARIN. Any IPv4 addresses that ARIN receives from the IANA or recovers from revocations or returns will go toward meeting the requests of companies on the waiting list.



WHAT'S HAPPENING

Researchers Make Strides **Toward Faster Wireless**

Terahertz waves could be a speedier successor to the microwaves now used to carry conversations and data via cellular and wireless networks. There are hurdles to making terahertz possible, but researchers at Brown University say they have overcome one by creating a system for multiplexing terahertz waves. As seen below, the researchers' device uses a "leaky wave antenna" made from two metal plates (one with a small slit) that form the waveguide. As the waves travel through, they leak out at different angles and separate in a form of demultiplexing. A receiver would accept waves at a particular angle, gathering data from a single stream.



FRONTSIDE WHAT'S HAPPENING INTERNET

Study Finds "Alarming" Indications That Internet Growth Is Slowing

About 43% of the world's population has regular access to the Internet, according to the Broadband Commission For Digital Development, which is part of the ITU. But that means about 4.2 billion people still don't have access. By the end of this year, the ITU predicts there will be 3.2 billion people online, but we won't reach the 4 billion Internet user milestone until 2020. "Alarmingly, there are indications that Internet growth is slowing," the report notes. Infrastructure, limited awareness about the Internet's potential, and a lack of content in many native languages are seen as primary challenges to increased adoption.





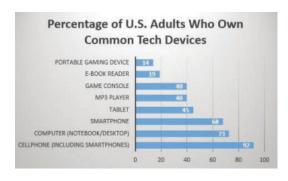
Job Of The Month

ESET, the security software company that grew from humble beginnings in Slovakia to more than 1,000 employees in offices worldwide, has an opening in its R&D branch in Montreal for a software engineer. The job entails maintaining and improving the company's reputation system and writing code to analyze and process data. ESET knows the best candidates have plenty of options for where to work, so the company is quick to let applicants know it offers more than just a paycheck. You'll have flexible work hours, including the chance to work two days a week from home. The cafeteria is "always filled with endless goodies," and you may get the opportunity to travel to headquarters in Bratislava or one of the branch offices in cities such as San Diego, Sydney, or Prague. The ideal candidate will have a degree in CS or a related field and be a whiz with Python, Java, and C++. You also must have experience with big data open-source tools such as Hadoop, Cassandra, and Hive/Impala. Oh, and you need to know something about network security. If living in the land of the Loonie sounds appealing, check it out, eh?

Source: www.eset.com

Mobile Rules; But PCs Popular, Too

Americans love their technology devices. Surveys conducted this year by the Pew Research Center show that smartphones continue to increase in popularity, with about 68% of American adults owning at least one of the devices. Overall cell



phone penetration has now reached 92% of the adult population. Personal computers continue to be popular, too, although ownership among one subset of adults (young adults ages 18-29) has dropped from 88% to 78% in the past five years. Pew researchers theorize that smartphones may be serving as PC substitutes for some people under age 30. That may also be the case with MP3 players, as ownership among that same subset of young adults dropped from 75% in 2010 to 51% in 2015.

Source: Pew Research Center

"Windows Ate My PC . . . "

Tech support horror stories are legendary in the computer industry, and the folks who handle the "Help, I can't find my files!" phone calls from desperate users have pretty much heard it all. Although there are some strange tales out there, the majority of tech support calls actually deal with fairly mundane issues. RESCUECOM is a third-party tech support company that periodically publishes reports that tally up



calls to the company by category. The table at right shows what was driving calls for help to RESCUECOM during Q3 of this year.

Source Of Computer Problems For Tech Support Calls To RESCUECOM During Q3 2015

Windows OS & Windows App Problems	56.4%
Viruses, Spyware & Malware	11.3%
Slow Computer	7.4%
Hardware Install / Setup	5.9%
Internet Connection Issues	4.9%
Printer Trouble	4.8%
Email Problems	3.4%
Data Recovery	2.5%
Mac App Concerns	1.3%
Failure To Boot / Blank Screen	1.2%
Phone Installation / Setup Problem	0.5%
Mac OS Difficulties	0.4%
Other User-Created Issues	0.1%
TOTAL (Rounded)	100%

16%

Percentage of people polled in the United States this year who say they have a "somewhat negative or very negative" view of the Internet industry. The poll has been taken annually since 2001 as part of an ongoing study by Gallup. In contrast, 60% of people polled this year say they have a "somewhat positive or very positive" view of the industry.

Gallup

85%

Percentage of U.S. adults who watched broadcast TV at some point during the past week.

The Nielsen Company

765 million

Number of households worldwide that will subscribe to some type of broadband service by the end of this year. The figure represents 38% of all households in the world.

Parks Associates

\$34 billion

Forecast value of the total smart home market (devices and services) in the United States by the year 2020.

ABI Research

\$80 billion

Expected annual revenues generated by software in the digital games industry this year. This number is forecast to increase to \$104 billion by the year 2018. PC games will account for 42% of the total this year, with the rest divided among mobile and console.

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Intel NUC

Tiny. Powerful. Complete.



ntel's diminutive NUC mini-PCs have always been a great option for lots of users in all kinds of situations who need an ultra-compact PC that is flexible and highly functional but doesn't use much power or take up much space. But up until now, they've always been barebones PC kits that required you to install your own memory and storage in order to function. The latest NUC, NUC5PGYH (code-named "Grass Canyon"), changes all of that.

Everything Inside

The latest NUC is powered by Intel's Pentium N3700 processor, a quad-core CPU with a base frequency of 1.6GHz and a burst frequency of 2.4GHz. The N3700 is built on a 14nm manufacturing process, has 2MB

of L2 cache, and supports up to 8GB of SODIMM DDR3L-1600 system memory. The chip also comes with Intel HD Graphics onboard, with a 400MHz base frequency and a 700MHz burst frequency, support for DirectX and OpenGL, and support for a host of proprietary video features including Intel Quick Sync Video, Intel InTru 3D Technology, Intel Clear Video HD Technology, Intel Wireless Display,

As powerful and feature-packed as the Pentium N3700 is, it still manages an incredibly stingy TDP (Thermal Design Power) of just 6 watts, which means your NUC will stay cool, even when running high-end, resource-intensive applications.

Other components that make up this impressive mini-PC include 2GB of DDR3L, a soldered-down 32GB eMMC (embedded MultiMediaCard) module with Windows 10 preinstalled, and an external 12V-19V DC wallmount power adapter. The NUC5PGYH also includes onboard Wi-Fi 802.11ac and Bluetooth, a Gigabit LAN port, an infrared sensor, four external USB 3.0 ports (two on the front and two in the back; the top port on the front is a Chargeable port that will charge mobile devices even when the NUC is powered down), two USB 2.0 ports via an internal header, a headphone/microphone jack, a VGA port, an HDMI port (this provides up to 7.1 surround audio, by the way), a headphone/TOSLINK jack, and an SDXC slot. The unit also includes an internal bay for a 2.5-inch SSD or hard

Advertisement

COVER STORY



drive, allowing you to greatly expand the NUC's storage capabilities.

If you're keeping score at home, this parts list means one very important thing: The NUC Mini-PC (NUC5PGYH) is ready to power up and go, right out of the box. Although you can easily expand its onboard SODIMM DDR3L memory and its available storage space via the SDXC card slot and the internal 2.5-inch SSD/hard drive mount, you don't have to add anything as in the past to get this NUC up and running.

Flip Your Lid

As with recent NUC kits, the NUC-5PGYH comes with a VESA mount that lets you put your NUC just about anywhere (including the back of your

monitor if you want), as well as a set of multi-country plugs for international use. But one of its coolest and potentially useful additions is its removable lid. The black lid that comes with the NUC looks great and does its job admirably, but in the event that you'd like to, you can spice things up with a replacement lid, either from a third-party vendor or using one that you make yourself.

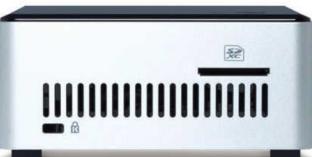
To that end, Intel's NUC website (www.intel.com/nuclid) includes a mechanical drawing of the lid and files you can download and use to create your own lid with a 3D printer. Replacement lids can be as simple as a custom lid with a different color or the decorative pattern of your choice, or as involved as a lid that includes an NFC

(near-field communications) or wireless charging header.

Ready When You Are

The newest member of the NUC Mini-PC family, the NUCPGYH, is the first Intel NUC that's available as a complete system and is ready to go the moment you get it home. And despite its four-inch-square footprint, NUC offers quad-core Intel computing performance and the power of Intel HD Graphics, as well as full wired and wireless connectivity and a host of peripheral and accessory options. Whether you're looking for a mini-PC for work or play, Intel NUC serves up desktop PC performance and a full Windows 10 experience in a tiny package.







GeForce GTX 950 \$179.99 **GIGABYTE** www.gigabyte.us

GIGABYTE GeForce GTX 950 (GV-N950XTREME-2GD)

■ IGABYTE recently shipped us its STREME GAMING GeForce GTX 950, which is a feature-packed pixel-pusher with a sky-high factory overclock, but it's priced right for budget-conscious gamers.

The GPU under the hood of this card features NVIDIA's Maxwell architecture and is based on the same GM206 chip that powers the GeForce GTX 960, which currently retails for between \$200 and \$240. The primary differences between these cards are the number of CUDA cores (768 vs. 1,024) and texture units (48 vs. 64), and in the memory speed (6.6GHz GDDR5 vs. 7GHz GDDR5). The GTX 950 keeps pace with the more powerful GTX 960 with the same 32 ROPs, the same 128-bit memory bus, and both GPUs feature 2.94 billion transistors manufactured using a 28nm process. The GTX 960s are available in both 2GB and 4GB variants, whereas the GTX 950's frame buffer will universally be 2GB.

There are a number of differentiating characteristics on this card compared to other GTX 950s currently available. NVIDIA's reference design GTX 950 has base and boost clocks of 1,024MHz and 1,188MHz, respectively. GIGABYTE's copper heatpipe

and aluminum fin WINDFORCE 2X cooler, equipped with a pair of 90mm fans, dissipates enough extra thermal energy to let GIGABYTE pump up the base and boost clocks to 1,203MHz and 1,405MHz, easily making this card one of the fastest GTX 950s you can buy. The memory clock also gets a boost from the stock 1,650MHz to 1,750MHz. GIGABYTE is able to achieve this thanks in part to its GPU Gauntlet sorting technique, which lets the firm single out the fastest GPUs capable of the most consistent power switching.

Other extras this card has in common with many Ultra Durable GIGABYTE graphics cards include the porous aerospacegrade protective coating applied to the PCB to prevent damage from moisture, dust, and corrosion; a 2-ounce copper inner core PCB; long-life solid-state capacitors; the same metal chokes found on the Titan X; and lower RDS(on) MOSFETs. Overclockers can also try their hands at squeezing even more performance from this unit with GIGABYTE's intuitive OC GURU 2 software.

In the benchmarks, this card performs admirably at 1,920 x 1,080, and even

Specs & Scores	GIGABYTE GeForce GTX 950
Core/Boost Clocks (MHz)	1,203/1,405
Memory clock (MHz)	1,750
Memory interface	128-bit
Memory	2GB GDDR5
3DMark Professional (Fire Strike)	5800
Graphics Score	6262
Physics Score	16519
Unigine Heaven 4.0	(1,920 x 1,200)
Score	660
FPS	26.2
Games	(1,920 x 1,080)
Metro: Last Light (DX11, Very High,16XAF)	47fps
Aliens vs. Predator (Very High, 4XAA, 16XAF, SSOA)	49.9fps
Witcher 3: Wild Hunt (Vsync Off, Unl. FPS, Ultra)	32.85
	(2,560 x 1,440)
Metro: Last Light (DX11, Very High, 16XAF)	30.33fps
Aliens vs. Predator (Very High, 4XAA, 16XAF, SSOA)	30.5fps
Witcher 3: Wild Hunt (Vsync Off, Unl. FPS, Ultra)	24.29

manages better than 30fps in every game save The Witcher 3 when running at 2,560 x 1,440. Compared to the GTX 960s we've tested, this little tyke only falls shy by about 6fps in the Aliens vs. Predator and Metro: Last Light benchmarks. Although NVIDIA pitches this card as ideally-suited to resource-light MMORPG and MOBA games, GIGABYTE's impressive tweaks give you an edge in virtually any 1080p gaming scenario.

BY ANDREW LEIBMAN

Specs: GPU: Maxwell GM206; Core Base/Boost Clocks: 1,203MHz 1,405MHz Boost; Memory Clock: 1,750MHz; Memory Bus: 128-bit; Frame Buffer: 2GB GDDR5; Factory Overclocked: Yes; Ports: dual-link DVI, HDMI, 3 DisplayPort



ENERMAX ETS-T40F-BK

NERMAX's ETS-T40Fit lineup of air coolers feature a heatsink that's only 1.7 inches wide, a slim design that helps ensure that the heatsink (and its attached fans) won't present any clearance issues for your system memory. We took a look at the ETS-T40F-W last month, which is an all-white model that includes two of ENERMAX's CLUSTER ADVANCE fans that spin at up to 2,200rpm. The ETS-T40F-BK features the same slim heatsink, but it opts for a black paint job and comes with a single ENERMAX T.B. APOLLISH fan with a PWM range between 800 and 1,800rpm.

The ETS-T40F-BK's T.B. APOLLISH fan will pull or push air (depending on which side you install the fan to) to the rear exhaust fan. ENERMAX also includes another set of fan mounting clips, so you can set up a

push-pull configuration by adding a second 120mm fan. Within the aluminum fin array, ENERMAX utilizes its VEF (Vacuum Effect) design that prevents cool air from leaking out of the fin structure before it passes all the way through the heatsink.

The black motif of the ETS-T40F-BK is uniformly applied to the aluminum fin structure and copper heatpipes. The heatsink's base in the only place where the black coating isn't applied. Here, ENERMAX uses its Heat Pipe Direct Touch design, which lets the four 6mm heatpipes make physical contact with the integrated heat spreader on the processor (with a thin layer of thermal paste sandwiched between them, of course). The included T.B. APOLLISH fan features a matching black frame with blue LEDs that illuminate light

reflex strips on the fan blades. The resulting effect appears as a curved line on each blade.

The single T.B. APOLLISH fan can generate up to 75.98cfm at 1,800rpm, as well as a maximum static pressure of 2.28mm/H2O. The "T.B." stands for "Twister Bearing," which is a long-life bearing that ENERMAX rates for a 160,000-hour MTBF. The Twister Bearing design also contributes to the ETS-T40F-BK's low noise output, which ENERMAX rates that a 26dBA maximum. In our testing, even under load, the ETS-T40F-BK was barely audible inside the case.

The ETS-T40F-BK didn't perform quite as well as the ETS-T40F-W, but that's to be expected, since the black edition comes with only one fan. When cooling an Intel Core i7-6700K at idle, we recorded a maximum temperature of 25 degrees Celsius. To stresstest the cooler, we ran POV-Ray 3.7 for 10 minutes, which raised the max temp to 68 C—two degrees higher than the ETS-T40F-W. For maximum heat, we ran Prime95's Small FFTs torture test for 10 minutes. The ETS-T40F-BK responded by limiting temperatures to 78 C; by comparison, the ETS-T40F-W held the Core i7-6700K to a 74 C max temperature.

With only a few degrees separating the ETS-T40F-BK from the ETS-T40F-W, enthusiasts can easily make up the difference by adding a second fan to the air cooler. We like that ENERMAX provides a few different color options within the ETS-T40Fit lineup, so you can pick one that best matches your rig's color scheme. Overall, ENERMAX shows that air coolers are still viable alternatives in today's market.

BY NATHAN LAKE

ETS-T40F-BK \$45.99 ENERMAX www.enermaxusa.com

Specs: Materials: Copper (base, heatpipes), aluminum (fins); Fans: 1 x 120mm PWM (800 to 1,800rpm max); Cooler dimensions: 6.4 x 5 x 2.7 inches (HxWxD); Socket compatibility: Intel LGA775/1150/1151/1155/1156/1366/2011(3), AMD AM2/AM2+/AM3/AM3+/FM1/FM2/FM2+; Warranty: 1 year Test system specs: Processor: Intel Core i7-6700K; Motherboard: GIGABYTE GA-Z170X-GAMING G1; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; RAM: Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730: OS: Windows 10 Enterprise (64-bit)





EK-XLC Predator 240 \$199.99 **EKWB** www.ekwb.com

EK-XLC Predator 240

K Water Blocks is well known among enthusiasts for its custom liquid cooling hardware, and the Sloveniabased company is now applying its expertise to closed-loop coolers. The EK-XLC Predator 240 includes a bevy of high-end liquid cooling components fitted into a preassembled kit that's simple to install and requires no maintenance. For example, the EK-XLC Predator 240 includes a Laing DDC liquid cooling pump and EK's Vardar high static pressure fans-both of which allow for speed regulation based on temperature demands. And with a maximum pump speed of 3,000rpm and a top fan speed of 2,200rpm, enthusiast performance is virtually assured. You've never seen a closed-loop CPU cooler quite like the EK-XLC Predator 240.

We're unabashed fans of EKWB's Supremacy MX CPU water block, and it's built into the EK-XLC Predator 240. The Supremacy MX features a machined copper base and high-flow design. Coolant inside the loop goes through a nozzle inside the block that speedily distributes heat across thin channels to quickly pull heat away from your CPU. The water block is a proven performer that further helps to increase the EK-XLC Predator 240's cooling capability.

At the top of the Supremacy MX water block are two standard G1/4 threaded

ports where EK connects its ZMT (Zero Maintenance Tubing). The rubber black tubing won't let you see the liquid coursing through the loop, but it does feature an industrial grade synthetic rubber (EPDM) that can withstand heat and doesn't suffer from any leaching effects that can gunk up the coolant. The use of industry standard connections is handy, as well, because it lets you expand your loop should you wish to add a GPU to the mix. EKWB provides detailed instructions on how to do so in the users manual.

The ZMT runs from the water block to the Laing DDC pump, which is built into the 240mm radiator. The downside of this design, compared to a water block/ pump combo, is that the radiator pump unit's expanded size (295mm) might not fit into every case. In our Cooler Master MasterCase Pro 5, for example, the EK-ELC Predator 240 could fit into the front chassis opening, but not into the top chassis' 240mm space. The included 240mm radiator is a member of EKWB's CoolStream family, which features an allcopper core for superior heat dissipation to aluminum fin radiators.

The two Vardar F4 120mm fans were developed by EKWB specifically for cooling radiators. At 2,200rpm, each fan can deliver 77cfm of airflow, as well as a static pressure of 3.16mm/ H20. The EK-XLC Predator 240 also

features an integrated fan splitter hub to keep the cables running from the kit to a minimum. You'll just need to run a PWM cable from the splitter hub to a fan connector on your motherboard, as well as a single SATA power cable to power the two Vardar F4 fans.

We paired the EK-XLC Predator 240 with a stock-clocked Intel Core i7-6700K and GIGABYTE's GA-Z170XP-SLI motherboard. At idle, maximum temperatures reached a mere 20 Celsius. Results were even more impressive under load. After running POV-Ray 3.7 for 10 minutes, maximum temperatures were only 52C, which is around 10 degrees cooler than most other closed-loop coolers we've tested with 240mm radiators. Prime 95's Small FFT torture test offered similarly remarkable results, as maximum temperatures reached only 58C.

Based on the temperatures under load, it's clear that the EK-ELC Predator 240 is a notch above your standard closed-loop CPU cooler. We also like that you can expand its cooling capabilities to other components. If you're looking for custom cooling loop performance in a kit that you can install in less than 10 minutes, the EK-ELC Predator 240 is right up your alley. ■

BY NATHAN LAKE

Specs: Materials: Copper (waterblock & radiator); Socket compatibility: Intel LGA 1150/1151/1155/1156/2011 (3), Pump: 3,000rpm, 12V; Fans: 2 EK-Vardar F4 (2,200rpm max); Radiator dimensions: 68mm x 295mm x 133mm (HxWxD); Warranty: 2 years

Test Systm Specs: Processor: Intel Core i7-6700K; Motherboard: GIGABYTE GA-Z170XP-SLI; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; Memory 16GB Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise (64-bit)



Aero-800 (White or Black) \$79.99 Aerocool www.aerocool.us



Aerocool Aero-800

We'll forgive you if you feel like you've seen this case before. After all, Aerocool's Aero-800 bears a close resemblance to the Aero-1000, which we reviewed in the June 2015 issue and used as the case for the Battle Box, our CPU System Workshop build that we gave away at QuakeCon. Despite the similarities, the Aero-800 is its own case, offering several enticing features that warrant a closer look.

Externally, the Aero-800 is almost identical to the Aero-1000. It's the same height but slightly slimmer (7.9 inches wide vs. the Aero-1000's 8.3 inches), and it measures 0.7 inch shorter from front to back. Notably, Aerocool placed the power button and I/O panel on the front panel of the Aero-800; it's located on the top panel of the Aero-1000. The Aero-800's side panel window is quite a bit larger than the Aero-1000, so LAN party passersby can get a good look at your build's internals. The real differences become apparent when you remove that side panel and inspect the case's interior.

The first thing you're likely to notice (indeed, it was the first thing we noticed) when you open the Aero-800 is the massive PSU shroud that runs nearly the entire length of the chassis. Obviously, PSU shrouds have been a mainstay in the modding community for several years, and case manufacturers are clearly getting in on the action now, too. The Aero-800's shroud is a welcome addition, and it also hides the case's two 2.5/3.5-inch drive bays. Builders who insist on impeccably clean interiors will certainly appreciate the Aero-800's PSU shroud.

Aerocool complements the PSU shroud with an array of cable management holes. The motherboard tray is positively littered with them, particularly if you opt to install a microATX or Mini-ITX motherboard. There are also holes cut into the top edge of the motherboard tray in order to route 8-pin CPU power cables, front panel cables, and so forth. With three 2.5-inch SSD mounts on the back side of the motherboard tray, the Aero-800 makes it

almost laughably easy to keep wires and cables out of sight.

There's plenty of room inside the Aero-800 to build an impressive system. By positioning all of the case's drive bays either behind the motherboard tray or within the PSU shroud, builders essentially have the entire front-to-back space of the chassis to install graphics cards. That amounts to 15.3 inches of clearance—in other words, any graphics card you want. The case gives you the option to install up to a 240mm radiator along the top panel as well as a 280mm rad behind the front panel. The Aero-800's internal structure tends to make installing a custom loop with a pump and reservoir (or a pump-res combo unit) slightly tricky, but as we learned from working with the Aero-1000, it can be done.

As usual, Aerocool gives you quite a bit of case for the money. The Aero-800 has everything you need to build a terrific system without spending a ton of cash.

BY VINCE COGLEY

Specs: Dimensions: 19.7 x 7.9 x 18.7 inches (HxWxD); Materials: Steel, plastic; Motherboard support: Mini-ITX, microATX, ATX; Drive bays: 2 x 5.25-inch external, 3 x 2.5-inch internal, 2 x 2.5/3.5-inch internal; Fans (included): 1 x 120mm LED front, 1 x 120mm rear; Fans (optional): 2 x 120mm or 2 x 140mm top, 2 x 120mm top; Ports: 2 x USB 3.0, 2 x USB 2.0, audio I/O

ASUS ROG MAXIMUS VIII EXTREME & ROG MAXIMUS VIII IMPACT





ROG MAXIMUS VIII EXTREME/ROG MAXIMUS VIII IMPACT \$499/\$249 | ASUS | www.asus.com

SUS' ROG motherboards are always tantalizing, and this month we have two ROG motherboards on handthe MAXIMUS VIII EXTREME and MAXIMUS VIII IMPACT. The EXTREME model is an E-ATX motherboard that boasts premium overclocking capabilities and the IMPACT is a Mini-ITX motherboard that features as much cutting-edge hardware as ASUS can fit into the tiny form factor. Both mainboards also include exceptional onboard audio, networking, and next-generation connectivity (including U.2 and USB 3.1 Type-C ports). Clearly, these eighth-generation ROG MAXIMUS mainboards are ready to rock your full-tower or small form factor rigs.

Z170 Amplified

Intel's Skylake processors certainly have some overclocking headroom, and ASUS fortifies the power handling of these ROG MAXIMUS motherboards to let enthusiasts reach the performance limits of their Skylake processors. Both the MAXIMUS VIII EXTREME and MAXIMUS VIII IMPACT include ASUS' Extreme Engine DIGI+ digital power architecture for precise and stable voltage delivery. For example, there are multiple power phases for CPU input voltage, DRAM voltage, and iGPU voltage. The MAXIMUS VIII EXTREME also offers a power phase for the VCCSA system agent.

Both motherboards also use customdesigned MicroFine Alloy Chokes that ASUS indicates offer half the inductance loss, 75% less hysteresis loss, and higher efficiency than conventional chokes. It all adds up to lower operating temperatures. Should temperatures rise, the ROG MAXIMUS VIII motherboards also feature black metallic capacitors that can operate under temperatures from 125 degrees Celsius to -75C.

To provide precise control over settings, ASUS includes a dedicated base clock generator that works with the TPU (Turbo Processor Unit) for fine-grain adjustments of CPU and DRAM frequencies, multipliers, and voltages. ASUS calls the collection of OC hardware "PRO Clock" technology. PRO Clock includes a wide variety of OC options, and it even lets you adjust BCLK amplitude and BCLK slew rate, which can help you to achieve better stability with overclocked BCLK frequencies. Overall, you can push BCLK frequencies up to 400MHz.

Both motherboards also support extremely fast DDR4. The MAXIMUS VIII EXREME can handle DDR4 sticks clocked at 3,866MHz, and the MAXIMUS VIII IMPACT go even higher at 4,133MHz. ASUS allows for such high-performance memory by optimizing trace layouts. ASUS' T-Topology is also onboard to support timealigned signal transfer for better DRAM stability and compatibility.

The comprehensive ROG UEFI BIOS is well-suited for enthusiasts. Just open the Extreme Tweaker tab and you'll be able to access individual field values for frequencies and voltages. You can also create a favorites list and shortcuts for the settings you adjust most frequently. If you don't feel like adventuring within the manual settings, you can use the Ai Overclock Tuner, which provides wizard-like OC tuning capabilities for CPU, memory, and RAID configurations. Once any changes are made, the ROG UEFI BIOS will display them before exiting, so you can remember what you've altered.

Studio Sound

ASUS SupremeFX 2015 audio is present on both boards, though the implementation is slightly different. The MAXIMUS VIII EXTREME has ASUS' SupremeFX 2015 chipset onboard, while the MAXIMUS VIII IMPACT includes a discrete sound card that provides all of the same hardware.

ASUS added several new components to the latest version of SupremeFX, including an ESS ES9023P Sabre DAC that provides 24-bit stereo D/A conversion and works with Sabre's Time Domain Jitter Eliminator for noise- and jitter-free playback. SupremeFX 2015 also uses Nichicon capacitors that ASUS says deliver a warm, natural, and immersive sound. Those with high-quality headsets will like the onboard Sonic SenseAmp, which auto-detects headphone impedance and switches to the correct ohm level.

Both boards include ASUS' Sonic Studio II software, which lets you tune audio settings and offers a number of features ideal for gamers, such as the Perfect Voice tool that removes ambient noise, distortion, and sound artifacts. Another new feature is the Casting Enhancer, which works with Open Broadcaster Software, X-Split Gamecaster, and Broadcaster to give game audio streams clearer and crisper broadcast audio.

Gamer-Focused

ROG MAXIMUS VIII motherboards come with an Overwolf utility that lets you apply personalized overlays to your games. And unlike game extensions, Overwolf's overlays don't interact directly with a game's engine, so they won't be detected as cheats. Overwolf supports more than 700 games, and besides in-game apps, it also offers tools for broadcast, audio chat, instant messaging, and entertainment (such as Pandora or Spotify). Overwolf can display up to five main apps in-game, and you can customize which apps show up.

ASUS also includes its Keybot technology that lets you add macro keyboard shortcuts and improve keyboard functionality. With Keybot II, ASUS ties the utility into its Turbo App and allows you to create custom macros for individual programs. The Turbo App will automatically switch among those profiles as necessary. There's also some new functionality in S5 mode. For instance, you can now turn on your PC via the keyboard by holding down the ENTER key for two seconds. Holding down the C, L, and R keys for two seconds will clear the board's CMOS. You can also remap the function keys as needed.

For the lowest-latency network connection, these ROG MAXIMUS VIII mother-boards include GameFirst Technology, which prioritizes game packets over background applications. GameFirst Technology features a few preset modes, including Optimization, Game, Media Streaming, and File Sharing, so you can easily adjust packet prioritization for certain types of network activity.

Both these MAXIMUS VIII mother-boards also embed an 802.11ac Wi-Fi/Bluetooth module, and ASUS offers a beta version of GameFirst IV that allows for Multi-Gate Teaming, which combines the network bandwidth from the onboard Wi-Fi and the wired connection. In addition, the beta version comes with an Intelligent mode that learns which software you use most frequently and optimize bandwidth for packets traveling to and from those applications.

More About The MAXIMUS VIII EXTREME

Serious overclocking enthusiasts require real-time monitoring for temperatures, clock speeds, and voltage. With the MAXIMUS VIII EXTREME, ASUS includes its OC Panel II that functions as an overclocking command center. You can install it in a 5.25-inch bay, where the 2.6-inch display will display critical hardware info and let you control fan speeds. But where the OC Panel II really shines is when it's used as an external control console. In this mode, you have arrow keys and selector buttons for direct control over key system voltages and frequencies.

The OC Panel II console also offers extra inputs for temperature sensors and fan controls. When you open up the console, there are two temperature headers and four extra fan headers, so you'll have direct heat readings and better control over cooling. For those benching with liquid nitrogen, the OC Panel II also lets you attach two type-K digital thermometers into the console's subzero sense ports for real-time temps between -200 and 200 degrees Celsius. Clearly, OC Panel II is an incredibly useful tool for those trying to reach extreme speeds and possibly set benchmark records.

ASUS provides some serious support for next-generation storage and I/O standards on the MAXIMUS VIII EXTREME. Internally, there's a M.2 port that supports both PCIe and SATA SSDs, as well as a U.2 port that supports 2.5-inch Intel's SSD 750 drives. There are also two SATA Express ports. On the rear panel, there are three USB 3.1 Type-A ports and one reversible USB 3.1 Type-C port.

The MAXIMUS VIII EXTREME is an overclocker's dream come true. Onboard power handling is ready for punishing loads and temperatures, and the OC Panel II connectivity lets you make adjustments to critical settings on the fly. The ROG UEFI BIOS gives you access to every frequency and voltage control we can think of. Couple the overclocking chops with exceptional onboard audio, networking, and gaming extras, and you've got a killer combination for performance enthusiasts.

Specs: Max memory: 64GB DDR4 (DDR4-2133; Max OC: DDR4-3866); Slots: 4 PCle 3.0 x16, 2 PCle x1; Storage: 8 6Gbps SATA, 2 SATA Express, 1 M.2 (Type 2242/2260/2280/22110), 1 U.2; Rear I/O: 1 DisplayPort, 1 HDMI, 4 USB 3.1 (1 Type-C and 3 Type-A), 4 USB 3.0, 1 PS/2, 1 S/ PDIF, audio I/O, 1 Ethernet, 1 Clear CMOS button, 1 BIOS Flashback button, 1 Wi-Fi GO! module; Form factor: E-ATX; Warranty: 3 years

Test system specs: Processor: Intel Core i7-6700K; GPU: ZOTAC GeForce GTX 980 AMP!

Extreme Edition; Memory: 16GB Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise

MAXIMUS VIII IMPACT Details

Now, you can't really expect ASUS to fit all of the extraordinary hardware found on the MAXIMUS VIII EXTREME into a Mini-ITX motherboard, but there's still plenty to get excited about. The rear panel of MAXIMUS VIII IMPACT features a debug LED, a Start/Reset button, a BIOS Flashback button, and a Clear CMOS button. Overclockers can take real-time voltage readings via ProbeIt measurement points, which are located under the SupremeFX Impact III audio card. LN2 and Slow Mode jumpers are available, too, for those benching with liquid nitrogen.

The MAXIMUS VIII IMPACT includes three onboard fan headers, and ASUS expands your fan control by providing a daughterboard boasting three additional fan headers. The daughterboard connects via an included fan cable and essentially turns the EXT_FAN header into three PWM fan headers. It's powered by a Molex connector and features three thermal sensor inputs, so the fan speed can adjust to temperature readings. Alternatively, fans connected to the daughterboard can spin at the speed provided by the EXT_FAN header.

ASUS also includes support for next-generation storage and devices via its U.2 port and two USB 3.1 ports (one Type-C and one Type-A). With no room for an M.2 slot, the inclusion of U.2 for Intel's 750 SSD series (and others that may use U.2) is a nice addition. If you're putting together a small form factor build for LAN party use, enthusiasts will have a tough time finding anything that will top the MAXIMUS VIII IMPACT.

Specs: Max memory: 32GB DDR4 (DDR4-2133; Max OC: DDR4-4133); Slots: 1 PCle 3.0 x16; Storage: 4 6Gbps SATA, 1 U.2; Rear I/O: 1 HDMI, 2 USB 3.1 (1 Type-C and 1 Type-A), 4 USB 3.0, 1 S/PDIF, audio I/O, 1 Ethernet, Clear CMOS button, Wi-Fi antenna ports, Start button, Reset button; Form factor: Mini-ITX; Warranty: 3 years Test system specs: Processor: Intel Core i7-6700K; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; Memory: 8GB Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise

MAXIMUS VIII Benched

We tested these motherboards with a nearly identical set of components-an Intel Core i7-6700K, ZOTAC's GeForce GTX 980 AMP! Extreme Edition, and a 240GB Intel SSD 730 Series. The only difference was that we went from 16GB of Crucial Ballistix Sport DDR4-2400 to 8GB in the MAXIMUS VIII IMPACT, as it only offers two DIMM slots. Both mainboards handled our benchmarks with ease. In the CPUintensive POV-Ray 3.7, for instance, these MAXIMUS VIII mainboards both topped 1,900 pixels per second. Similarly impressive results can be seen in 3DMark Professional's Fire Strike Extreme test with overall scores of 6400 (MAXIMUS VIII EXTREME) and 6391 (MAXIMUS VIII IMPACT). \blacksquare

BY NATHAN LAKE

Benchmark Results	MAXIMUS VIII	MAXIMUS VIII
	EXTREME	IMPACT
Price	\$499	\$249
3DMark Professional (Fire Strike Extreme)		
Score	6400	6391
Graphics Score	6785	6777
Physics Score	11820	11779
Combined Test	14.08	14.01
PCMark 8		
Creative Score	5816	5743
SiSoftware Sandra 2015		
Dhrystone Integer Native AVX2 (GIPS)	209.44	201.67
Whetstone Single-float Native AVX (GFLOPS)	114.88	112.23
x32 Multi-Media Integer AVX2 (Mpixels per second)	410	403.31
x16 Multi-Media Long-int AVX2	193.65	194.7
x1 Multi-Media Quad ALU	2.25	2.1
x16 Multi-Media Single-float FMA	387.05	386.66
Integer Memory Bandwidth B/F AVX/128 (GBps)	28.75	28.3
Floating Memory Bandwidth B/F AVX/128 (GBps)	29.1	29
Cinebench 15 CPU score (points)	910	880
POV-Ray 3.7 (pixels per second)	1910.45	1900.92
CrystalDiskMark 5.0.2 (MBps)		
Sequential Read (Q32T1)	560.8	550.2
Sequential Write (Q32T1)	294	270.7
4K Read (Q32T1)	177	170.4
4K Write (Q32T1)	161.4	159.5
Games (frames per second; tested at 2,560 x 1,600)		
Metro: Last Light (16xAF; SSAO off)	70.69	70.65
Aliens Vs. Predator (8XAA, 16xAF)	71.2	71
Dying Light (Med, AO On, AA On, Vsync Off)	73.7	73.2
The Witcher 3 (Vsync off, Unl.fps, Ultra)	46	45.7

Supermicro C7H170-M

The tight confines and limited airflow of a small form factor rig often make for a hotter environment than systems in a mid- or full-sized tower. Supermicro's C7H170-M is a microATX motherboard that's built with stability and reliability in mind, while still providing support for Intel's Skylake processors, M.2 storage, and a few expansion card slots. As you might guess by the title, the C7H170-M runs Intel's H170 chipset, which is quite comparable with Intel's Z170 chipset. Typically, the H variant of Intel's chipsets don't support overclocking, but Supermicro uses a special hardware design and BIOS that lets you adjust the base clock on your Skylake processor. Read on for a deeper look at Supermicro's C7H170-M.

As part of Supermicro's new SuperO lineup, Supermicro adds its "server DNA" into the C7H170-M's PCB, capacitors, sockets, and ports. The PCB, for instance, features extra layers of material, which helps to ensure signal integrity. The material in these extra layers is qualified for Supermicro's server standards and is ideal for providing stability while overclocking. The C7H170-M can also deliver low capacity variance, thanks to X5R and X7R ceramic chip capacitors throughout the motherboard.

For best connectivity, Supermicro uses 15-micron-thick gold plating on the PCIe sockets, connectors, and CPU socket. Besides helping to create a perfect connection with your hardware, the gold plating also helps ports to resist corrosion over time. You also can be assured that the C7H170-M is ready-to-go when you receive it, because Supermicro tests the mainboard under its full-load server testing at 100% load for at least 150 hours.

As with most H170 chipset motherboards, which are generally more budget-friendly, you won't find a



C7H170-M \$159.99 Supermicro www.supermicro.com

Supermicro's C7H170-M is a microATX board that is part of the company's new SuperO lineup of products aimed at gamers. Products in the line merge server-level quality and reliability with features for enthusiasts. The goal is to provide users with fast and stable gaming platforms.

boatload of extras on the C7H170-M. There's support for Intel's 6th Generation processors, DDR4 memory at 2133MHz, and a single PCIe x16 slot. The latter isn't really much of a limitation on a microATX motherboard, as there's usually only room for one dual-slot GPU anyway. The C7H170-M also provides a PCIe x4 slot and PCIe x1 slot, should you need to install an add-on card, though the PCIe x4 slot would be blocked by a dual-slot GPU. You can install up to 64GB of memory into the board's four DDR4 DIMM slots.

For storage, there are six 6Gbps SATA ports and an M.2 slot. The six 6Gbps SATA ports support RAID 0, 1, 5, and 10 configurations. The M.2 slot can utilize four PCIe 3.0 lanes to expose the maximum potential bandwidth to M.2

SSDs. Supermicro also maximizes M.2 compatibility by including screw holes for 2260, 2280, and 22110 form factors.

As small form factor rigs are more likely to use on-processor graphics than a full-sized system, the onboard video outputs on a microATX are extremely important. Supermicro provides you with one HDMI 1.4, one DisplayPort 1.2, and one DVI-D output. Both the HDMI and DisplayPort outputs can handle up to 4K resolutions. There's also an S/PDIF audio output, which is helpful if you plan on connecting your SFF rig to an A/V receiver. A Realtek ALC1150 high-definition audio codec is onboard to provide up to 7.1-channel surround sound. Analog audio ports, of course, are also on the rear panel.



The connectivity options on Supermicro's C7H170-M include four USB 3.0 ports, two USB 2.0 ports, and a PS/2 port on the rear panel. Internally, the board has two USB 3.0 headers and one USB 2.0 header.

For external I/O connectivity, the C7H170-M offers four USB 3.0 ports, two USB 2.0 ports, and a PS/2 port on the rear panel. Wired network connectivity is handled by Intel's i219-V. Internally, there are two USB 3.0 headers and a USB 2.0 header. Supermicro also includes a few onboard conveniences that will help you to quickly recovery from system problems. Near the DIMM slots, you'll find a Clear CMOS button, a Power button, and a BIOS Restore button. The latter will look for BIOS (must name file SUPER.ROM) from any of the USB ports, and it will automatically update the BIOS, which is extremely helpful to overcome a corrupted BIOS.

On the whole, the C7H170-M benchmark results were on par with the Z170 chipset motherboards we've tested. For example, a score of 6653 of 3DMark's Fire Strike Extreme graphics test is right up there with the top Z170 options. The C7H170-M also did well in the processor-intensive Cinbench 15 (871 points) and POV-Ray 3.7 (1894.16 pixels per second) benchmarks. Storage speed in CrystalDiskMark 5.0.2 was strong as well, with Sequential Read Q32T1 speeds of 557.3MBps and Sequential Write Q32T1 of 294.9MBps.

The H170 chipset is a solid core for small form factor rigs, and Supermicro does much to enhance reliability on the C7H170-M. Supermicro also offers a microATX Z170 variant, the C7Z170-M, if you want a little more overclocking options, such as CPU multipliers and system memory, in your small form factor build. Otherwise, the C7Z170-M offers a similar set of features to the C7H170-M. The two microATX options also show that Supermicro is growing their consumer motherboard lineups to fit specific needs.

BY NATHAN LAKE

Benchmark Scores	Supermicro C7H170-M
3DMark Professional (Fire Strike Extreme) Score	6653
Graphics Score	7072
Physics Score	12814
Graphics Test 1	37.41
Graphics Test 2	26.1
Physics Test	40.68
Combined Test	14.3
PC Mark 8	
Creative Score	5753
SiSoftware Sandra 2015 Processor Arithmetic	
Dhrystone Integer Native AVX2 (GIPS)	198.44
Whetstone Single-float Native AVX (GFLOPS)	109
Processor Multimedia	
x32 Multimedia Integer AVX2 (Mpixels)	405
x16 Multimedia Long-int AVX2	184.29
x1 Multimedia Quad ALU	2.13
x16 Multimedia Single-float FMA	395.11
Games	2,560 X 1,600
Metro: LL (16XAF, SSAO Off)	70
Aliens VS. Predator (8XAA, 16XAF)	71.2
Dying Light (Med, AO On, AA On, Vsync Off)	73
The Witcher 3: (Vsync Off, Unl. FPS, Ultra)	44.3

Specs: Max memory: 64GB DDR4 (DDR4-2133); Slots: 1 PCle x16, 1 PCle x4, 1 PCle x1; Storage: 6 GGbps SATA, 1 M.2 (type 2260/2280/22110); Rear I/O: 1 HDMI, 1 DisplayPort, 1 DVI-D, 4 USB 3.0, 2 USB 2.0, 1 PS/2, 1 optical S/PDIF out, audio I/O, 1 Ethernet; Form factor: microATX; Warranty: 3 years Test system specs: Processor: Intel Core i7-6700K; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; Memory 16GB Crucial DDR4-2133 CL15 @ 1.2V; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise

GIGABYTE GA-Z170XP-SLI

If you want support for both upcoming and legacy devices on the Z170 chipset, GIGABYTE's GA-Z170XP-SLI is the motherboard for you. For emerging storage devices, it's got an M.2 slot, three SATA Express ports, and two USB 3.1 ports (one Type-C and one Type-A connector). An internal Thunderbolt header is available, too, if you want to add a GIGABYTE Thunderbolt card. On the legacy side of things, you'll find two PCI expansion slots, as well as a parallel port and a serial port header. Priced at \$150, the GA-Z170XP-SLI is also a good fit for gamers on a budget.

As you might expect, the GAZ170XP-SLI doesn't come with all the overclocking conveniences, such as an onboard debug LED and power button, that are common on GIGABYTE's higher end products. But that doesn't mean you can't overclock with this board. GIGABYTE includes its TURBO B-Clock Tuning IC for linear range adjustment of the BCLK anywhere from 90MHz to 500MHz. The ability to alter the BCLK 1MHz at a time, rather than a 5% range adjustment, makes for precision overclocks.

The GA-Z170XP-SLI also features GIGABYTE's Ultra Durable technology, so you know the power handling is good enough for speedy overclocks. GIGABYTE uses 15 micron thick, gold plated pins in the CPU socket to ensure you'll never have to deal with bad contacts or corroded pins. GIGABYTE's DualBIOS is onboard, too, so you'll always be able to go to a backup BIOS in the unfortunate event of a BIOS failure. DDR4 support is excellent with maximum module speeds reaching 3466MHz. In short, GIGABYTE makes sure the GA-Z170XP-SLI has all of the basic OC tools to get the job done right.



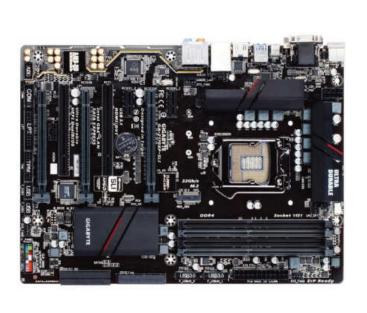
The included M.2 port uses a PCIe 3.0 x4 pipeline to support M.2 SSDs at up to 32Gbps. You can install both PCIe-and SATA-based M.2 SSDs, and three M.2 form factors are supported: 2242, 2260, and 2280. For full-speed SATA Express, each of the three ports supports 16Gbps bandwidth. The six SATA connectors on the SATA Express ports, of course, also serve as 6Gbps SATA ports for conventional SSD connectivity. The 6Gbps SATA ports support RAID 0, 5, and 10 configurations.

The rear I/O panel is comparatively sparse, but GIGABYTE makes up for this with lots of internal headers. If you've got a case with lots of frontpanel connectivity, the design is certainly a bonus. Available USB ports, for example, include 6 USB 2.0 (two rear, four internal), 7 USB 3.0 (three rear, four internal), and 2 USB 3.1 (two

rear). Notably, there's no optical S/PDIF port, should you be considering this motherboard for a HTPC build. Onboard video outputs include one VGA, one DVI-D, and one HDMI port (supports up to 4,096 x 2,160 resolution).

Those considering the GAZ170XP-SLI for a budget gaming rig won't be disappointed. It supports both SLI and 3-way CrossFire via the three PCIe x16 slots. In a 2-way setup, both GPUs will run at x8 speed. Additional expansion cards can be installed into the two PCIe 3.0 x1 slots or two PCI slots. We like that one of the PCIe x1 slots is located above the top PCIe x16 slot, so the PCIe x1 slot will be free even if you run multiple graphics cards. The two legacy PCI slots are positioned near the bottom of the board.

The GA-Z170XP-SLI does include some interesting extras, as well. If



you register the motherboard into GIGABYTE's Heroes of the Storm sweepstakes before December 31st, 2015, you'll have the chance to win some cool skins and heroes, as well as a GIGABYTE motherboard, mouse, or headset. The GA-Z170XP-SLI features a black PCB and black heatsinks that'll blend in with most any rig. An amber (a shade of yellow and orange hues) LED runs along the audio section of the PCB, and you can program it to beat to the rhythm of your PC's music, pulse, stay continuously lit, or turn off completely (if you want a more subdued look).

We wouldn't expect a \$150 motherboard to push past any of the higher-end GIGABYTE motherboards we've tested, but the GA-Z170XP-SLI doesn't lag behind either. It posted similar scores in 3DMark (overall score 6656) and PCMark (Creative score of 5767) to the pricier GA-Z170X-UD5. It held up in our processor- and memory-intensive tests, too. In Cinebench 15, for example,

the GA-Z170X-UD5 produced a score of 883, and the SiSoftware Sandra's Memory Bandwidth results of 28.34GBps (Integer) and 28.48 (Floating) are first-rate. In our games testing at 2,560 x 1,600, the motherboard posted 73.9fps in Dying Light and 45.7fps in The Witcher 3.

With the GA-Z170XP-SLI board, GIGABYTE shows that you don't have to pay big bucks to see great performance. Sure, there aren't a lot of showy luxuries, but it's got everything you'll need for the latest enthusiast hardware. And those users with some legacy PCI devices, such as a wireless card, will find support, too. If you're an enthusiast looking for a way to shed some cost on your Skylake build, you should certainly consider the GA-Z170XP-SLI. ■

BY NATHAN LAKE

GA-Z170XP-SLI \$150 **GIGABYTE** www.gigabyte.us

Benchmark Scores	GIGABYTE GA-Z170XP-SLI
3DMark Professional (Fire Strike Extreme) Score	6656
Graphics Score	7084
Physics Score	12822
Graphics Test 1	37.49
Graphics Test 2	26.14
Physics Test	40.71
Combined Test	14.25
PC Mark 8	
Creative Score	5767
SiSoftware Sandra 2015 Processor Arithmetic	
Dhrystone Integer Native AVX2 (GIPS)	197
Whetstone Single-float Native AVX (GFLOPS)	108.5
Processor Multimedia	
x32 Multimedia Integer AVX2	401.22
x16 Multimedia Long-int AVX2	184
x1 Multimedia Quad ALU	2.13
x16 Multimedia Single-float FMA	385.28
Games	2,560 X 1,600
Metro: LL (16XAF, SSAO Off)	70.68
Aliens VS. Predator (8XAA, 16XAF)	71
Dying Light (Med, AO On, AA On, Vsync Off)	73.9
Witcher 3: Wild Hunt (Vsync Off, Unl. FPS, Ultra)	45.7

Specs: Max memory: 64GB DDR4 (DDR4-2133; Max OC: DDR4-3466); Slots: 3 PCI-E x16, 2 PCI-E x1, 2 PCI; Storage: 8 6Gbps SATA, 3 SATA Express, 1 M.2; Rear I/O: 1 DisplayPort, 1 HDMI, 1 DVI-D, 1 VGA, 2 USB 3.1 (one Type-C and one Type-A), 3 USB 3.0, 2 USB 2.0, 1 PS/2, audio I/O, 1 Ethernet, Form factor: ATX: Warranty: 3 years

Test system specs: Processor: Intel Core i7-6700K; GPU: ZOTAC GeForce GTX 980 AMP! Extreme Edition; Memory 16GB Crucial Ballistix Sport DDR4-2400; Storage: 240GB Intel SSD 730 Series; OS: Windows 10 Enterprise





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Dave 'drdavient' Cooper 20 GAME DEVELOPER

Dave is a man of many hats. Literally. He splits his time between tech entrepreneurship, game designing, guitar playing and songwriting, university educating, and improvised performance. Dave uses a **MasterCase 5** system for his independent 2D game development and playing needs, but which thanks to the **FreeForm™ Modular System** also offers the flexibility to customize, adjust, and upgrade to meet the demands of whatever catches his fancy in the future.

Learn more about his system and Blockships 2D, an arena combat fight fest game that he's been working on at Coolermaster.com/Dave

MasterCase 5 - Make of It What You Will.



Core P5 \$149.99 Thermaltake www.ttesports.com

Core P5

Nobody appreciates modded PCs as art better than *CPU*. Just flip to the Mad Reader Mod in this issue and you'll see yet another world-class example of a PC that's pleasing to the eye yet brutal with the benchmarks. But thanks to Thermaltake and the new Core P5, you can concoct a system worth showing off without having to leave your day job and convert your bathroom into an ersatz paint booth.

Thermaltake refers to the Core P5 as a "wall-mount" chassis; and sure enough there's a heavily reinforced VESA mount on the backside to let you hang it from your wall, but there are also a pair of steel and plastic flippers included for a vertical setup, and a quartet of conical plastic case feet for horizontal configurations. Thermaltake's Core P5 comes with a 5mm-thick acrylic sheet that mounts to chromed steel pegs at each corner of the chassis. The acrylic comes covered with a protective film to make sure it remains immaculate until you're ready to show the

The enclosed portion of the chassis is 2-inches wide by approximately 24-inches high and 22-inches deep. The right/top side of this open-air chassis acts as an extended motherboard tray, supporting up to ATX motherboards. The power supply installs below the motherboard, there's an external mounting slot for one of the three internal HDD/SSD bays to the right, and the rest of your custom watercooling components mount to the right side of the case. Rubber grommeted holes peppering the panel let you route cables out of sight.

One of the cooler additions to this package is the horizontal graphics card cage, which lets you mount this component parallel to the motherboard. Thermaltake also throws in the flexible x16 PCIe ribbon cable that makes this possible. Staunch traditionalists can, of course, mount the graphics card

perpendicular to the motherboard if they

There's nothing preventing you from air cooling a system installed in/on the Core P5, but doing so would be missing the point. You can also forget about using one of those closed-loop coolers. This case is a dream for custom liquid cooling setups, particularly those that utilize hardline tubing. There's space on the right side of the Core P5 for a 480mm radiator, and room for a reservoir as tall as they come.

All the traditional benefits of working on an open-air case apply to the Core P5. The poor cable management that often plagues other cases of this type, however, is not an issue, thanks to the enclosed motherboard tray design. This case is a good choice for novice or experienced users looking to create a visually arresting liquid cooled system. ■

BY ANDREW LEIBMAN

Specs: Dimensions: 23.9 x 13.1 x 22.4-inches (HxWxD); Material: Steel, plastic, acrylic; Motherboard support: ATX, mATX, Mini ITX; Bays: 3 3.5/2.5-inch bays, 3 internal or 2 internal 1 external; Fan support: 4 120mm or 3 140mm on the left side; Ports: 2 USB 3.0, 2 USB 2.0, audio I/O



Poseidon Z RGB Gaming Keyboard \$119.99 Thermaltake www.ttesports.com

Poseidon Z RGB Gaming Keyboard

The best keyboards are the ones that manage to blend style with substance, aesthetics with customization. There is no shortage of mechanical switch-enabled keyboards with RGB backlighting marketed toward gamers these days, but it's the little things about Thermaltake's Poseidon Z RGB that make it stand out.

This is a full-size 102-key keyboard with black keycaps and translucent white key markings. We like that even though this isn't a tenkeyless keyboard, Thermaltake took a minimalist approach to the size of the frame; the Poseidon Z RGB doesn't take up a large portion of your desk space.

There are RGB LEDs behind each key wired into a 32-bit ARM Cortex-M0 microcontroller, which enables several nifty lighting effects, brightness adjustments, and speed effect adjustments, in addition to up to five fully customizable profiles that you can create and save. For instance, the Wave effect cycles the colors in waves from the left to the right; Arrow Flow shoots rows of color originating from the keys you press; Ripple radiates colored patters around each keystroke; Reactive mode emits a short burst of light on each key

you press and slowly fades it out. The fully lighted options include an always-on option, a pulse, breathing, or a running spectrum, which slowly cycles through all 16.8 million colors.

There are two reasons Thermaltake's RGB lighting looks so good (aside from the microcontroller). The first is a mirrored plate that surrounds the switches and generously reflects the light framing each key. The second is in Thermaltake's design, which features a translucent white housing on either side of the LED to better diffuse light across the whole underside of the key, making the characters really pop.

The Poseidon Z RGB comes with your choice of Tt eSPORTS brown (with a 45cN actuation force) or blue (50cN actuation force) switches, and like those other switches, they translate into a quieter and lighter mechanical response and a more audible and traditional "bump" response, respectively. We've had extensive experience with a variety of mechanical keys, and after several extended sessions with the Poseidon Z RGB, we can barely tell the difference between it and similar switch types. The Poseidon Z RGB we tested features the

brown keys, and the typing sensation was virtually identical to that of the Cherry MX brown switches in the Cooler Master Mech we use on a daily basis. Thermaltake's keys were a tad quieter.

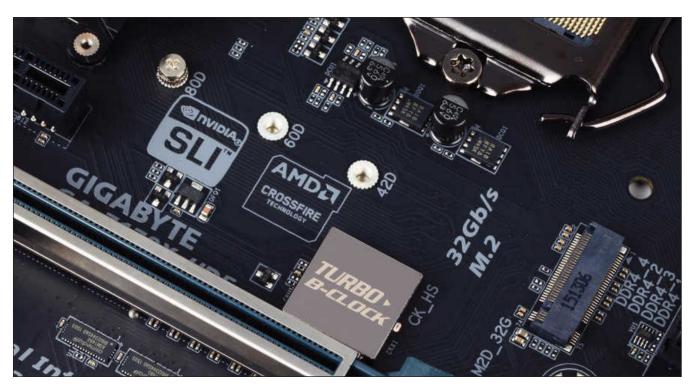
The keyboard lets you tweak the color patterns, effects, and manage profiles via a handy Windows-based software utility. Macros are supported as well, but if you're not keen to launch the software to make a tweak, you can do so using the dedicated macro recording switch in the upper-right corner of the keyboard. There are also five programmable function keys and even a disable Windows key function that prevents game-ending errant taps of the ill-placed key. Multimedia keys are also available as alternate function keys on the top row.

The Poseidon Z RGB is everything a serious gamer wants in a keyboard; stunning customizable RGB backlighting, your choice of tactile and audible feedback, numerous customizations and support for custom profiles, and all backed by a solid 5 year warranty. What's not to love?

BY ANDREW LEIBMAN

Specs: Mechanical switch type: Tt eSPORTS Certified Mechanical Switches Brown/Blue; 50 Million keystrokes; 16.8 Million color LED backlight; 32-bit ARM Cortex-M0 microcontroller; 7 multimedia keys; 5 game profiles; 510 macro sets; 512KB onboard memory; 100% anti-ghosting with 104 key rollover; 1,000Hz polling rate; USB interface; 5 year warranty

State-Of-The-Art Standards



Most M.2 slots on Z170 motherboards, such as the GA-Z170X-UD5 seen here, support up to 32Gbps bandwidth.

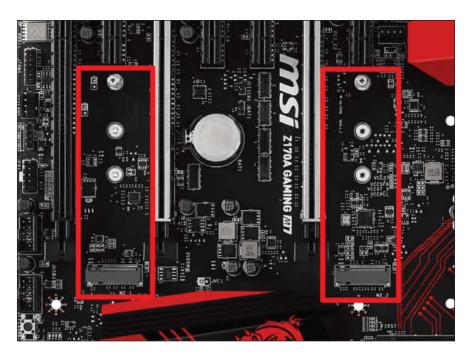
Intil recently, the types of expansion slots, onboard ports, and internal headers you'd find on a motherboard was fairly static. Generally, you could expect a motherboard to have a few PCIe x16 and PCIe x1 slots, SATA ports, and USB headers. But with storage technology surpassing the performance limits of 6Gbps SATA, new standards and interfaces are necessary to support next-generation drives. M.2—in addition to a few others, such as SATA Express and U.2-provide a bigger pipe for storage data by allowing it to transmit over a chipset's PCIe lanes. M.2's low profile is ideal for portable

devices such as tablets, thin laptops, and all-in-ones, as well as builds where there's no room for an add-in card or 2.5-inch drive. Besides storage, M.2's interface also supports other functions, including Wi-Fi, Bluetooth, WWAN, and NFC. In short, M.2 is a versatile standard that you'll likely be seeing more of in years to come.

From NGFF To M.2

M.2 began life as NGFF (Next Generation Form Factor) and was initially utilized for add-in mobile modules, such as 3G and 4G mobile broadband cards. "It became apparent this new socket definition would best be served in an industry standard setting and was brought under the auspices of PCI-SIG," says Al Yanes, PCI-SIG chairman and president. NGFF would go onto to replace the PCI Express Mini Card for communication devices in laptops, as NGFF is smaller and could be used with multiple communication standards.

NGFF also supports PCIe, SATA, and USB interfaces, and it wasn't long before technology experts took notice. "The Serial ATA International Organization (SATA-IO) leveraged this form factor and definition to create its mSATA specification," says Yanes. Moreover, the industry recognized



Some Z170 motherboards come with two M.2 ports, such as MSI's Z170A GAMING M7.

that NGFF was a specification that could become something much greater. "With NGFF, there was a golden opportunity to define a single specification which would serve the needs of both communication devices and solid-state storage devices in a modular form factor," says Yanes. "An MOU (Memorandum of Understanding) was established between the PCI-SIG and SATA-IO to enable members from both organizations to collaborate on specification development."

The PCI-SIG and SATA-IO groups decided to rename NGFF to M.2 and officially released M.2's 1.0 specification in December of 2013. "It [M.2] was selected as the preferred name of the specification, yet it carries no specific meaning," says Yanes. The collaboration also helped to ensure M.2 would be electrically compatible with both SATA and PCIe interfaces, so it could bridge the gap as storage moved from the SATA bus to the PCIe bus. At the logical interface level, M.2 also supports AHCI (Advanced Host Controller Interface) and NVMe

(Non-Volatile Memory Express). The latter is designed to take full advantage of storage devices with non-volatile memory, such as Intel's SSD 750 Series, by exploiting parallelism and more efficient interrupt processing.

M.2 Gains Momentum

Motherboard manufacturers immediately took notice of M.2's benefits, as

M.2 slots began to appear in some Z87 motherboards via a Mini PCIe combo card that included a free M.2 slot next to a Wi-Fi/Bluetooth combo module. "M.2 was developed to improve upon the speeds of mSATA and traditional SATA SSDs, and we definitely see a very large improvement from the M.2 connection," says Leon Chen, business development manager at GIGABYTE.

Intel saw where the future of storage was headed, too, and added support for PCIe-based storage with the Z97 chipset. This meant that motherboard manufacturers no longer needed an add-in module or a third-party controller to provide you with M.2 or SATA Express support. Everything was not perfect for M.2 on the Z97 chipset, though. There are only eight PCIe 2.0 lanes on Z97, and M.2 slots often shared bandwidth with the motherboard's SATA Express ports and SATA ports. Enthusiasts, of course, would prefer to have all slots available to them.

Another issue, at the time of Z97's release in May 2014, was that M.2 PCIe-based storage devices were still just prototypes, so early adopters had to use SATA-based M.2 storage that weren't any faster than the SSDs of the time. And when combined with Z97 PCIe chipset lane constraints, M.2 slots on Z97 motherboards were typically limited to two



The ASUS X99-DELUXE comes with one M.2 slot, and you can add another via the included Hyper M.2 x4 add-in card.

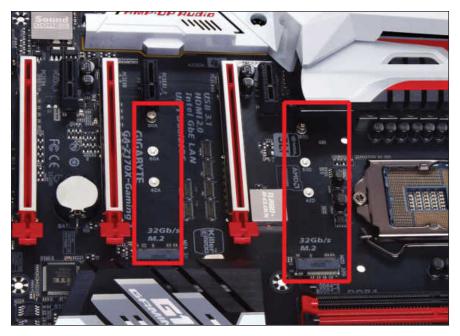
PCIe 2.0 lanes that maxed out at 10Gbps bandwidth. Make no mistake, 10Gbps was a significant jump over SATA's 6Gbps bandwidth, but as we're seeing with today's PCIe-based storage devices, 10Gbps is the low end of what M.2 SSDs can do.

Intel's X99 chipset has the same eight PCIe lanes as Z97, but motherboard manufacturers have a little more freedom because they can steal PCIe lanes from the processor. "The X99 platform provides up to 40 PCIe lanes from the CPU side," says Sam Tsai, product manager at MSI. "Therefore, most motherboard makers plan on including support for one or two M.2 devices." Using PCIe 3.0 x4 lanes from the CPU pushes M.2 maximum bandwidth to 32Gbps. And with PCIe M.2 SSDs already pushing reads of 2,500MBps (20Gbps), there's a clear need for motherboards to support four PCIe 3.0 lanes via M.2.

Intel's Z170 chipset makes it even easier for motherboard manufacturers to support M.2, because Z170 increases the number and speed of the PCIe lanes at the PCH (Platform Controller Hub). To



This U.2 host adapter lets you use an M.2 slot on a GIGABYTE motherboard to support Intel's 2.5-inch, NVMe-based SSD 750 Series.



On GIGABYTE's GA-Z170X-GAMING 7, one of the M.2 ports is located above the top PCle x16 slot, so M.2 storage won't interfere with add-in cards.

start, the Z170 chipset offers 20 PCIe lanes that are independent of the PCIe lanes from the processor. "With Z170, we saw

> additional improvement as the chipset's PCIe lane speeds were updated to third-generation to allow for a maximum of 32Gbps, while the second-generation lanes on previous chipset generations allowed for only 10Gbps," says Chen.

> In practical application, the improvements to the Z170 chipset allows motherboard makers to load up on support for next-generation storage. Tsai tells us "the Z170 platform can support up to three PCIe storage devices, all over PCIe 3.0 x4." Typically, you'll find a mix of SATA Express and M.2 ports, which is smart move because it allows for some flexibility with storage connectivity.

In general, we've found that most Z170 motherboards include at least one M.2 port and two SATA Express ports.

For extra M.2 connectivity on the Z170 chipset, some motherboard makers might also opt to include a second M.2 slot that shares bandwidth with a PCIe slot. GIGABYTE's GA-Z170X-UD5, for instance, includes two M.2 ports. The bottom M.2 ports shares PCIe lanes with the bottom PCIe x16 slot that runs at x4 speed. If an SSD is installed into the GA-Z170X-UD5's bottom M.2 slot, the associated PCIe x16 slot will be unavailable.

Another way that some motherboard manufacturers expand M.2 connectivity on Z170 is to include multiple M.2 slots and SATA Express ports that share bandwidth with each other rather than with any of the PCIe add-in slots. For example, MSI's Z170A GAMING M7 comes with two M.2 slots and two SATA Express ports, as well as six SATA ports. With 20 PCIe 3.0 ports, there are a lot of possible configurations. You could, for instance, have two M.2 PCIe SSDs, one SATA Express SSD, and two SATA drives, or alternatively, one M.2 PCIe SSD, two SATA Express SSDs, and two SATA SSDs.

On the AMD side, few motherboards natively support M.2. If you're running an AMD processor, you'll likely need go with an M.2 add-in card that will attach to one of the free PCIe slots on your motherboard.

Read Your Keys

As we've mentioned, the PCI-SIG and SATA-IO groups designed M.2 to be an adaptable standard that supports a variety of communication and storage devices. To this end, the M.2 specifications define keys (similar to how DDR2, DDR3,

To make matters more confusing, M.2 devices can feature two key types on single connector. "A storage module can be keyed for both B and M pinouts—provided it is a PCIe x2 device," says Yanes. We found that many SATA M.2 SSDs use a connector notched for both B and M keys. This design helps to avoid compatibility issues and doesn't lower performance because the SATA M.2 SSDs operate at less than 10Gbps. The recent increases in PCIe M.2 SSD performance, though, mean there will be more M key M.2

designed to support wireless modules, and motherboard manufacturers often denote these sockets as M.2 Wi-Fi in both documentation and onboard labels to help make sure you don't install an M.2 SSD into the slot.

Socket 2 isn't often found on mother-boards, as it matches up with B key M.2 devices that are limited to two PCIe lanes. Instead of Socket 2, motherboard manufacturers almost exclusively use Socket 3 for M.2 SSDs, as it supports four PCIe lanes and M key devices. When used with an M.2 SSD with a

B key and M key, Socket 3 will drop to PCIe x2 speed.

As M.2 is a relatively new standard, labeling within motherboard documentation for M.2 devices isn't consistent. Some mainboard makers might list the M.2 socket type, while others list the key type supported. Others are even more general and list the type of M.2 devices you can install, such as "supports PCIe 3.0 x4 and SATA 6Gbps standards" or "32Gbps M.2 x4 support," for example.

Before you purchase an M.2 device, you'll want to check the motherboard specification to make sure the M.2 device is supported and will run at its full speed. For example, some motherboards might feature an M.2 slot that operates at only 10Gbps. A high-end PCIe M.2 SSD operating at 20Gbps could be installed into such a slot, but it'll only operate at 10Gbps.

NOTE: KEY OPTION IS A REPRESENTATION ONLY AND DOES NOT PROHIBIT ADDITIONAL OPTIONS 105 SIDE COMPONENT AREA TOP SIDE COMPONENT AREA TYPE 2220-X TOP SIDE COMPONENT AREA TYPE 2220-X TOP SIDE COMPONENT AREA TOP SIDE CO

M.2 devices can be manufactured in many different form factors.

and DDR4 modules have different key notches) to denote interface and device types. "Keying the connector means having a pin-efficient solution where the signal pinout can vary based on the key," says Yanes. "For example, a key B module can either be a communication device or a storage device, allowing platform OEMs the flexibility of including either type in a key B socket."

Despite the B key's protocol flexibility, today's fastest M.2 storage devices generally use an M key connector, because it can support four PCIe lanes, vs. the B key's two. Yanes tells us that "The 'extra' two PCIe lanes on key M pinout redefine some communication signals found on the key B pinout, and as such, PCIe x4 storage devices can only use key M."

SSDs in the near future.

Besides the M key and B key connectors, M.2 devices are also available with A key and E key connectors. Typically, M.2 devices with these keys are dedicated wireless communication modules, such as for Wi-Fi and Bluetooth connectivity. For compatibility, some M.2 wireless adapters feature both A key and E key notches. The PCI-SIG has created several other key types, including C, D, H, J, K, and L, with pin locations that are reserved for future use.

The M.2 Socket

With M.2 devices, you need to pay attention to the key connector, but on a motherboard, M.2 support is often (but not always) listed by socket types—of which there are three. Socket 1 is

M.2 Lengths

The variability of M.2 doesn't end with keys and sockets, because M.2 devices can also be manufactured in different form factors. Fortunately, most motherboards support multiple M.2 form factors, but again, an M.2 module's size is something you'll need to check before purchase.

With M.2, the form factor is a number code that represents the physical

dimensions of the card, such as 2230 or 2280. The first two digits are the width of the drive, though all current M.2 SSDs are 22mm wide. The following numbers are coded as the length of the M.2 device, so a 2242 M.2 form factor is 42mm long and a 22110 M.2 SSD is 110mm long. For M.2 SSDs, the most common form factors are 2242, 2260, 2280, and 22110.

Similar to their key and socket support, there's no standard way that motherboard manufacturers document supported M.2 form factors. The form form factor reserved for larger storage capacities, such as 1TB M.2 SSDs, that have yet to appear on the market.

M.2, SATA Express & U.2

When we talk about next-generation storage support on a motherboard, we typically list the number of M.2 slots and SATA Express ports. Early returns aren't looking for good SATA Express, though. First off, M.2 has SATA Express beat when it comes to maximum bandwidth, because SATA Express supports just two

Key ID	Pin Location	Interface
Α	8-15	2x PCle x1 / USB 2.0 / I2C / DP x4
В	12-19	PCIe x2/SATA/USB 2.0/USB 3.0/HSIC/SSIC/Audio/UIM/I20
С	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	2x PCle x1 / USB 2.0 / I2C / SDIO / UART / PCM
F	28-35	Future Memory Interface (FMI)
G	39-46	Not Used for M.2; for Custom/Non-Standard Apps
Н	43-50	Reserved for Future Use
J	47-54	Reserved for Future Use
K	51-58	Reserved for Future Use
L	55-62	Reserved for Future Use
M	59-66	PCIe x4 / SATA

The PCI-SIG has reserved several key layouts for future M.2 uses.

factor number is the most common but certainly not universal. Some motherboard documentation list only the supported lengths, such as "42mm, 60mm, and 80mm M.2 cards" or even "4.2cm, 6cm, and 8cm length cards." If the users manual doesn't indicate which form factor is supported, the lengths are usually printed near the retaining screw holes on the motherboard's PCB.

Wireless M.2 devices, such as Wi-Fi and Bluetooth combo cards, often feature a shorter M.2 form factor, such as 1630 or 2230, because the hardware doesn't take up as much PCB space as SSDs do. Most currently available M.2 SSDs aren't longer than 80mm, making them around the size of a stick of gum. The 22110 size appears to be a PCIe 3.0 lanes for a top-end speed of 16Gbps. The throughput of many PCIe SSDs already surpass the performance ceiling of SATA Express, so there's a real question if storage manufacturers will adopt it. Intel's 2.5-inch 750 SSD Series drives, for example, feature a U.2 connector that supports the same PCIe 3.0 x4 bandwidth as M.2.

Secondly, at press time, there were no SATA Express SSDs on the market, which isn't a good sign for an I/O technology that's been around since Z97. It's expected that SATA Express drives will retain the 2.5-inch form factor of conventional SATA SSDs. Similar to SATA drives, you'll need to connect a cable from your motherboard to the drive. On the plus side, SATA Express supports both AHCI and NVMe logical interfaces, as well as SATA and PCIe electrical interfaces. As such, SATA Express isn't without its charms, but it's possible that SATA Express will be passed over for U.2.

For Intel's 750 SSD Series, onboard M.2 slots will initially play a critical role for the U.2 connection. Intel's 2.5-inch SSDs come with a U.2 to mini-SAS cable, yet onboard mini-SAS ports aren't common, even on most recently released Z170 motherboards. Fortunately,

> motherboard manufacturers can provide support for Intel's SSD 750 Series via an add-in M.2 adapter card. For example, GIGABYTE's GC-M2-U2-MiniSAS is an M.2 add-in card with a mini-SAS connector. The adapter is compatible with all GIGABYTE 100 Series and 9 Series motherboards with M.2 support.

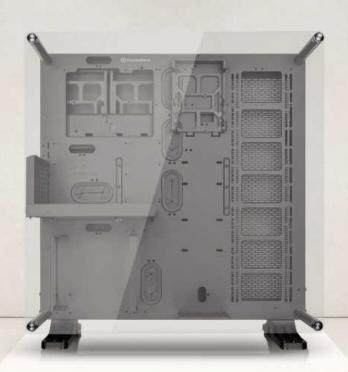
> Those who work in IT might be familiar with U.2, as the connection was originally called SFF-8639 and used as a server backplane for 2.5-inch storage. In June, the Small Form Factor Working Group announced that the SFF-8639 will now be known as the U.2 connector. There's no word as yet when motherboard manufacturers will begin to

provide onboard U.2 ports.

Small Form Factor Performance

When SATA SSDs were first introduced, it didn't take long for people to see the benefits of upgrading to the flash-based storage over hard drives. It was a simple process, because you just needed a few 6Gbps SATA ports and your motherboard was ready to go. With next-generation storage, you'll need a new interface, and M.2 is one of the easiest ways for you to immediately take advantage of today's fastest drives. When upgrading your PC, it's probably a good idea to select a motherboard with at least one M.2 slot, if not more. Even if you're not upgrading storage today, onboard M.2 should pay off down the road.

TAKE PRESENTATION TO THE NEXT LEVEL



CORE P5
ATX WALL-MOUNT CHASSIS



Crushing It Intel LANFest Summer 2015

Another summer, another great slate of Intel LANFest events. This month, we're taking a look back at three events that we sponsored (and at which we held our customary mod contests): Laclede's LAN 15, LANFest Sacramento Summer 2015, and LANFest Colorado 2015.

LANFest Laclede's LAN 15

On Saturday, August 8 at 8:30 a.m., St. Louis' premier LAN party kicked off with check-in and setup. The 155-plus-seat BYOC event would run until 3 p.m. or so the next day, and in the interim played host to tournaments in Counter-Strike: Global Offensive, Team Fortress 2, League of Legends, Dota 2, and Hearthstone. There were also Left 4 Dead 2 and QWOP events, a Console Corner stocked with party game faves, and much more.







Fran "220V" Silveira won the Laclede's LAN mod contest with this Corsair Graphite Series 760T-based rig with a liquid-cooled CPU, custom lighting and custom switches, and a whole lotta fans. Silveira made good use of the 760T's cable management slots, put a custom cover for the upper drive cage, and wrote his gaming handle on the windowed side panel.

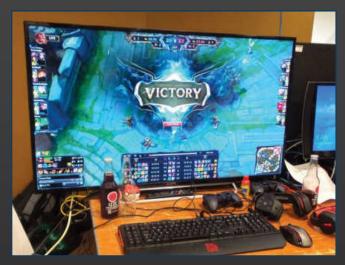


HARD HAT AREA



The 434-seat LANFest Sacramento once again hit Intel's Folsom campus for 48 hours, starting at 6 p.m. on August 21 and running through the same time on Sunday, August 23. Events during the LAN included contests in Ultra Street Fighter IV tourney, Minecraft, Mortal Kombat X, Heroes of the Storm, Super Smash Bros., and others, and official tournaments in Hearthstone, CS:GO, Team Fortress 2, and Rocket League. There were also informational workshops at LF Sacramento covering such topics as building PCs, sprite game programming, modding, NVMe SSDs, Parallax C programming, Python, and more. The event also included an overclocking contest and an Intel LANFest *CPU* Case Mod Contest.













HARD HAT AREA

Victory in the case mod contest went to the collaborative team of Lee Harrington and Johnnie Rodriques, who turned an NZXT Noctis 450 into the coolest Stormtrooper-themed mod that we've seen to date. The guys hung a picture of an old-school Stormtrooper Commander on the side of the rig to illustrate what they were going for (white armor with blue, battle-damaged accents to represent the Commander's pauldrons), and they painted a new Episode VII-style Stormtrooper helmet on the right-side panel. As if all of that isn't cool enough, the guys crafted custom GPU backplates with the Imperial sigil on them, added further insignia on the left-side panel forward of the window, and (naturally) installed an amazing rigid-tubing cooling loop and custom-sleeved cables.











HARD HAT AREA

LANFest Colorado 2015

This year, LANFest Colorado pulled in nearly 240 attendees, and take it from us, if you are within travel distance of Loveland, you owe it to yourself to attend this LAN party. The Ranch is a great location, the guys who run the event are top-shelf, and you will have a blast. This year's event kicked off on Friday, August 28 and ran through Sunday, August 30.







The LANFest Colorado mod contest went to Stosh Malec, whose Corsair Obsidian Seriesbased build includes a custom cooling loop with a cool-looking 5.25-inch bay reservoir, solid cable management, and some custom acrylic pieces that Malec used to cover his drive bays and to separate the PSU mount area into its own compartment. He also mounted his Intel SSD prominently on the outside of the bay cover, and as a nice little finishing touch, added a "PC Master Race" graphic in the upper-left corner of his windowed side panel.



MAD READER MOD







MAD READER MOD

Chiaroscuro

icholas "Greensabbath" Falzone submitted this month's Mad Reader Mod, Chiaroscuro, several years ago, but for a number of reasons its time didn't come until now. Better late than never, so the saying goes, and in this case (pun fully intended) we heartily agree, as this mod looks great and is one of the finest handcrafted wood PC enclosures we've seen to date.

Falzone says he was inspired to build this work of art when he saw a rendering of the Beijing Digital Building, which was constructed to be a data center for the 2008 Summer Olympic Games, while studying architecture at Cal Poly, San Luis Obispo.

"I liked to look at buildings and see if they could translate into a computer case design," he says. "This one seemed like a great place to start the design process from. I used my modeling and design skill from my architecture education and my background as a furniture maker as well as experience from past mods to make this case happen."

Falzone also offered some insight as to the meaning of the mod's name: "Chiaroscuro' is Italian for 'light and dark,' and refers to the contrast between the two," he says. "I wanted to use two contrasting woods for the case, ebony and maple, and the name seemed like a natural fit."

300

In addition to pieces of ebony (which Falzone describes as "almost jet black") and maple wood, Chiaroscuro incorporates a fair amount of brushed aluminum and of course the UV blue acrylic that really pops when ambient light is low and this

case lights up from the inside. Falzone says he spent roughly 300 hours during a three-month period building the case in a basement workshop. (He has since moved on to a bigger external shop, where he also builds furniture and bicycle frames on occasion.) His first step was to build a full-scale model of the case out of foam core, which was a big help and gave him a good idea of what to expect.

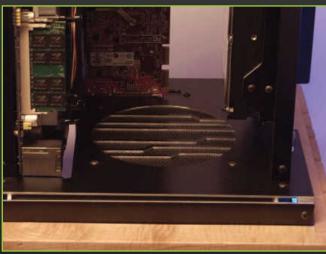
Falzone built the case from scratch (obviously), so he was able to design both the exterior and the interior chassis that holds the system's components. The interior is made mostly of aluminum plates that Falzone machined with a router and wooden templates and then screwed together.

"The interior of the case is split into two compartments," Falzone says. "The top holds the main components including the mobo, graphics card, hard drive, and the majority of the lighting system. The bottom section contains the PSU and DVD drive. The case is designed to move air from the bottom up and out of the vents at the top. All of the ports are hidden between the first and second compartments, so they are invisible from the outside."

Falzone also gave all of the fan grilles the same "circuit board" motif as the exterior, which he cut out by hand from brushed aluminum.

As you can see, the exterior of the case is made up of two parts, as well. The bottom portion, fashioned from curly maple, can be removed but is designed to be in place more often than not. The upper (ebony) portion is easy to remove and has adjustable maple fins that Falzone can open or close





depending on ambient temperatures, system work load, and various other factors. The cool lighting effect in the top portion comes via UV CCFL (cold-cathode fluorescent lamp) tubes and the aforementioned frosted UV blue acrylic attached to the wood, and Falzone can turn the lighting on and off with a remote control.

What's Inside

Chiaroscuro consists of an AMD Phenom X4 9350e mounted on a J&W MINIX 780G-SP128MB motherboard, 4GB of OCZ DDR2 SODIMM memory, a Radeon HD 4850, a SilverStone 650W power supply, and a Seagate 1TB hard drive.

Easy On The Eyes

Falzone says the aesthetic appeal of Chiaroscuro was important, as he wanted a case that he'd be proud to put anywhere in his house.

"Partially, this case was meant as an HTPC-type computer that you could have on display in your living room or wherever and not be embarrassed about it, but rather proud of having a beautiful object that serves a modern purpose," he says. "I also wanted to make it not look obviously like a computer, which is why you can't see where the ports are, and I really liked the idea of the lighting on the Beijing Digital Building and I wanted to see if I could emulate that in a computer case."

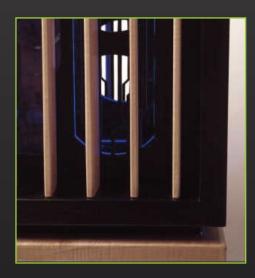
If you've seen the Beijing Digital Building (or pictures of it), you know that he can and did. ■

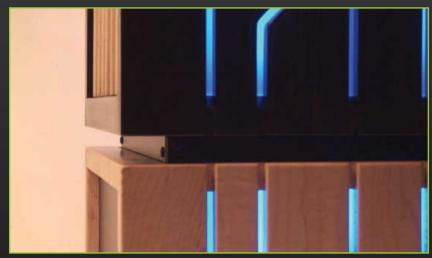
We Want Your Mod

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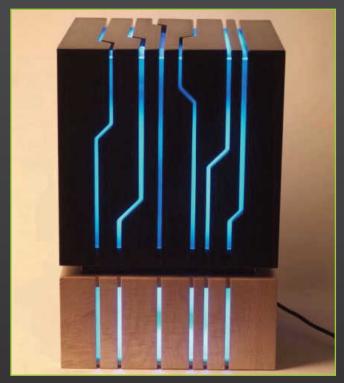


MAD READER MOD















Fight Fire With Quick Fire Cooler Master's Quick Fire Rapid-i & Quick Fire XTi **Smash The Competition**

Success in almost any type of PvP-FPS, MOBA, MMORPG-relies on acquiring and using the right gear. Once you go head to head with experienced players, it becomes abundantly clear that having the wrong weapons and armor can fry your bacon just as quickly as implementing a terrible strategy. Don't believe us? Ask the guy on the receiving end of the Sword of a Thousand Truths.

So, no one wants to make the mistake of marching into a melee with weaksauce in-game equipment, but why is it that some gamers try to get away with using substandard equipment on the other side of the screen? We're talking about peripherals, of course, and we're talking to you, owner of the headset with crackling mic, the mouse with a single DPI setting, the keyboard with the stuck WWWWWWW key.

It's 2015, and the market is as competitive as ever. It's time to retire those trusty excuses "There aren't any gaming peripherals that feel great to me" and "To get good gaming hardware, you have to empty your bank account." If you find that your input devices are holding you back, there's never been a better time to make a change. Let's start by taking care of that mushy mess you call a keyboard.

Options abound, of course, but Cooler Master has recently released a pair of mechanical keyboards that demand your attention. The Quick Fire XTi and Quick

Fire Rapid-i are a pair of lethal weapons that can light up a LAN party just as well as they can light up your competition.

Band Of Brothers

Over the last few years, Cooler Master has expanded its Quick Fire gaming keyboard family with worthy warriors, so these two newest recruits benefit from plenty of R&D, as well as any feedback Cooler Master has gathered from the enthusiast community. Because the Quick Fire XTi and Quick Fire Rapid-i aren't Cooler Master's first attempt at a high-performance gaming keyboard, to a certain extent they're battle-tested right out of the box.



The foundation of Cooler Master's new Quick Fire XTi keyboard is its Cherry MX mechanical keyswitches, which are highly regarded in the enthusiast community. Recognizing that not everyone prefers the same feel to their keyboard, Cooler Master offers the Quick Fire XTi with MX Blue, MX Red, or MX Brown switches.



Like its big brother, the Quick Fire Rapid-i uses Cherry MX switches and LED backlighting with a number of lighting effects.

Cooler Master considers the Quick Fire XTi the big brother to the Quick Fire Rapid-i's little brother, and indeed, their DNA is remarkably similar. First and foremost, both keyboards use Cherry MX mechanical keyswitches, and Cooler Master gives gamers three choices of keyswitch, ensuring they'll have a keyboard that keeps their fingers happy.

"A crucial feature the [Quick Fire XTi and Quick Fire Rapid-i] offer is the ability for the user to pick his/her switch type," says Alfredo Barroso, Cooler Master North American marketing specialist.

The two keyboards are available in three of Cherry's most popular flavors-MX Blue, MX Red, and MX Brown. If you're new to the mechanical keyswitch scene, these are distinct switches, each with its own characteristics. The Blues are for forceful gamers who like to make their presence known . . . audibly. This type of Cherry MX switch is both tactile, meaning it produces a tactile "bump" you can feel when the switch bottoms out, and clicky, which refers to the audio report the switch makes when it strikes the bottom of its housing. Of the three switches mentioned, the MX Blues are also the stiffest, requiring 50g of force to actuate.

If the MX Blue mechanical switch is the boisterous barbarian of the bunch, the MX Red switch is the ninja, going about its business quietly and effectively. Reds don't produce the same "clicky" sound that the Blues do, and as a linear switch, users don't receive any tactile feedback when the switch actuates. MX Red switches require slightly less force than the MX Blue

switches. Because they only need 45g of force to actuate. MX Red switches have developed a reputation as being a preferred option for gamers, as they're able to register keystrokes smoothly and rapidly.

Rounding out the trio is the MX Brown switch, which is a bit of a blend between the MX Red and MX Blue. Like the Reds. Brown switches are non-clicky, but they do give you the tactile bump that MX Blue partisans swear by. However, because they have the same 45g actuation force as the MX Red switch, some mechanical keyboard aficionados believe that the MX Brown switch's bump is more subtle than the MX Blue switch.

Cherry MX switches are a solid foundation, but let's be real: Lots of keyboards use them. Cooler Master has reached into its bag of tricks and outfitted the Quick Fire XTi and Quick Fire Rapid-i with additional features that should help give gamers an edge. Both keyboards boast ABS grip-coated keycaps, which are designed to keep gamers' fingertips in place when the action picks up and hands start sweating.

"Simply put, the applied grip coating gives you far superior control when gaming," Barroso says. "The texture allows the user to locate and stay on the right keys in the heat of battle."

The Quick Fire XTi and Rapid-i also let you quickly and easily adjust their repeat rate. According to Barroso, the keyboards' adjustable repeat rate lets users issue commands up to eight times faster than other keyboards. "This can be very beneficial in RTS games and other game types where button mashing is the difference between winning and losing," he adds.

Specs	Quick Fire XTi	Quick Fire Rapid	
Switch type	Cherry MX (Blue, Red, or Brown)	Cherry MX (Blue, Red, or Brown)	
Polling rate	1,000Hz/1ms	1,000Hz/1ms 1,000Hz/1ms	
Key rollover	N-key	N-key	
Keys	104	87	
 Macro support	Yes, 4 keys	Yes, 4 keys No	
Backlit	Yes (35 colors, 5 settings)		
	USB 2.0	USB 2.0	
	ABS, grip-coated, removable		
 Price	\$149.99	\$139.99	



Despite their sim-ilarities, the Quick Fire XTi and Quick Fire Rapid-i are each their own keyboard. Most obviously, the Quick Fire XTi has a standard, 104-key layout, while the Quick Fire Rapid-i uses a tenkeyless design, ditching the numeric keypad in favor of a smaller physical footprint. The Quick Fire XTi also offers macro support (including on-the-fly, hardware-based recording) that includes four macro keys, a feature that the Quick Fire Rapid-i forgoes.



Although the Quick Fire XTi and Quick Fire Rapid-i have slightly different LED backlighting implementations, what really sets them apart is their form factor. The Quick Fire XTi has a standard 104-key layout, while the Rapid-i ditches the numerical keypad in the interest of saving space.

The Light Show

With their Cherry MX mechanical keyswitches and grip-coated keys, the Quick Fire XTi and Rapid-i have the right makeup to help keyboard commandos achieve victory, but they're also built to look good while winning. The secret sauce is Cooler Master's take on keyboard backlighting.

The Quick Fire XTi and Quick Fire Rapid-i have slightly different implementations for their respective backlights. The Quick Fire XTi is equipped with per-key backlighting, and each key has a red and blue backlight. By mixing and matching color intensities, this lets you set each key to glow in one of up to 35 colors. But it's better than that. The Quick Fire XTi has several lighting modes, or effects (such as wave, water drop, and ActivLite), that respond to your keystrokes, and setting a mode is a simple matter. You'd be hardpressed to find another keyboard with such vibrant backlighting.

The Quick Fire Rapid-i's backlighting is brilliant, too. There's only one colorwhite-but it's just as striking as the Quick Fire XTi's red and blue combinations. You have the following five lighting modes at your disposal: Gaming Cluster (WASD and arrow keys), full LED backlight, full LED backlight with breathing effect, and two types of ActivLite backlighting. With the ActivLite effect, pressing a key activates its backlight; you can set ActivLite to turn off the backlight as soon as the key is released, or ActivLite can gradually fade the backlight, the latter of which is hypnotically cool when multiple keys are pressed in rapid succession. The Quick Fire Rapid-i gives you even more control over its backlighting by letting you adjust the brightness.

Even better, Cooler Master isn't stopping with the lighting effects you get out of the

box. For example, the company has already released firmware updates that turn both keyboards into a fully functional version of the classic game Snake. Expect the company to continue to introduce more light effects via firmware, making the future of the Quick Fire XTi and Quick Fire Rapid-i bright indeed.

High-caliber Firepower

Many gamers don't feel the need to make the move to a mechanical keyboard, figuring, "Hey, I can type just fine on this \$10 bargain basement keyboard." We won't explicitly fault someone for following this line of thinking, but why be "just fine" when you can be great? Cooler Master's Quick Fire XTi and Quick Fire Rapid-i are solid, no-nonsense keyboards with excellent construction and good looks. Do your fingers a favor and consider one of these keyboards for your next big upgrade. ■





TOTAL COMBINED WATTAGE		(45)	500W	SERVICE -	1 20.000
120 AND 200 (100 HADE)	120	w	456W	3.6W	12.5W
MAX CURRENT	18A	16A	ABE	0.3A	2.5A
DC OUTPUT	*3.3V	+5V	+12V	-12V	+5Vsb
AC INPUT	115/230VAC 10/5A 47-63Hz				



ON MARS

A LAN-Portable Contender

ltex Computers & Electronics is a San Antonio-based PC shop with a handful of retail locations throughout Texas. From the website, you can order components, prebuilt PCs, notebooks, and a variety of electronics devices. But our first introduction to Altex's impressive custom PC handiwork was at PAX South this last January. At the BYOC, Christopher S. was sporting the X99 Hammer, a modded Altex system that features some slick red vinyl work, an attractive hand-made PSU cover, impeccable wiring, and a gorgeous custom-built liquid cooling system. But with Altex's new AION MARS system, you don't need to be a modder to have your very own high-performance show piece.

All About AION

The company recently configured a souped-up version of its Mini-ITX powerhouse under the AION brand. According to Altex, AION is focused on making sure customers have access to high quality, high performance, and highly customizable computers, with Altex' same great customer service included. Each AION system is built to your exacting specifications, and they'll work with you throughout the build process to make sure the finished system looks and performs exactly how you want it to. Extras that you can request include custom lighting, closed-loop and custom liquid cooling, and performance tweaks that take advantage of the improved thermals inherent in a liquid-cooled computer system.

Good Things Come In Small Packages

We spoke to Miguel Couvertier, the Special Projects Manager at Altex, to get



The Altex AION MARS is a compact yet powerful PC. The system has a Mini-ITX motherboard (GIGABYTE GA-Z170N-WIFI) and a custom liquid cooling setup with a radiator located in the top panel.

some more details about what makes the AION MARS such a special system. Couvertier assembled the system himself, so he had lots of great insights into PC building that really come across in the AION MARS' build quality, tidy wiring, and overall component selection.

Before we delve into the hardware, we asked about the inspiration behind the MARS' name. "With our entire AION lineup, we wanted names that mean power and expressed what these systems were capable of," enthused Couvertier. "I'm a huge fan of Greek/ Roman mythology and it only seemed right to name this system after the god of war. With its small size it can easily be overlooked in terms of its performance but the MARS is a giant slayer and can go toe-to-toe with the best out there, making it worthy of the name."

As with many of the systems Altex currently offers, the AION MARS uses Intel's Z170 chipset as a foundation. According to Couvertier, "The Intel Z-series chipset doesn't hold back your system; it allows for overclocking and tuning, whereas other Intel series chipsets, such as the H170, don't." We learned the hard way that even motherboards that support overclocking features, such as the MSI H81M-E34 we used in our Pentium G3258 Anniversary Edition overclocking guide from the May issue, have had their meager overclocking capabilities retroactively nerfed. Indeed, it's not enough to have an unlocked processor, your motherboard needs to be

unlocked as well, and the Intel Z and X series chipsets are fully unfettered when it comes to overclocking.

Couvertier continues, "Overclocking can unleash your processor's true potential and provide large performance gains, especially for gamers." He also mentions that support for PCI Express 3.0, to take full advantage of the latest NVIDIA and AMD graphics cards, is crucial for the AION MARS. But the AION MARS doesn't just come out of the box ready for overclocking, Couvertier explains that Altex will go the extra mile and perform the overclocking on the CPU and GPU and even run stability testing to make sure the system remains reliable at idle and under load, day and night. "One of our trained technicians will ensure you get every ounce of power out of the components, making sure it's 100% stable."

One of the first things we noticed about the AION MARS is how easy it is to overlook; this thing is small for being such a powerful PC. When we asked Couvertier why Altex chose to go with a Mini-ITX form factor for the case and

One of the first things we noticed about the AION MARS is how easy it is to overlook; this thing is small for being such a powerful PC.

motherboard (GIGABYTE GA-Z170N-WIFI), he said that there are several positives, "The key benefit is portability, especially for LAN events, where it would normally be difficult to lug around a full size system and all your other hardware."

It's important for Altex, and by extension, its customers, that the AION MARS not come up short in the performance category, and the custom liquid cooling system Couvertier installed

helps in both these regards. By using a slim GPU block and a low-profile CPU block, the AION MARS can outsource a majority of its heat exchanging to a single radiator, installed in the top panel, where a pair of blue LED-lit 120mm Thermaltake Riing fans can force the air out quickly and efficiently. The space-saving water cooling kit also gives Altex more room to increase the clock speeds of the processor and graphics card.

A lot of what we love about the look of the AION MARS is thanks to the Phanteks Enthoo EVOLV ITX case. "Phanteks truly made an amazing case," says Couvertier. Highlights for Altex include the small size but roomy interior, and the removable radiator frame in the top panel, which makes dropping a custom loop into such a compact case a fairly painless endeavor. He also lauds the aluminum platform and bracket that serves a double purpose, to hide the graphics card power cables and as an attractive platform for the reservoir/ pump unit. There's also an AION by Altex logo sticker on the face of the bracket, which is clearly visible in the case's generous window.

Component flexibility is another factor that weighed heavily in Altex choosing this enclosure. There's space for a pair of 3.5-inch HDDs to the right of a full-size PSU bay, mounts for an SSD behind the right-side panel, and support for graphics cards up to 13-inches long.



The AION MARS packs a lot of powerful components into its Phanteks Enthoo EVOLV ITX case. You have a great view of Altex' custom liquid cooling loop through the system's side panel window.



Take the side panel off the case to show off the interior and you can see that this is one Mini-ITX computer that looks as good on the inside as it does on the outside.

The AION MARS we tested has a pair of 2TB WD Black HDDs near the PSU and a 1TB Samsung 850 EVO SSD on the backside of the motherboard tray. The PSU is a more-than-capable EVGA SuperNOVA 750 G2.

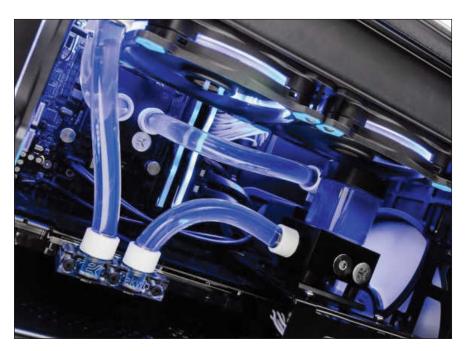
As you can see, Altex sent us a significantly upgraded version of the AION MARS, but the graphics card is one of this system's main attractions. MSI's GTX 980Ti 6GD5 V1 is the model, but Altex didn't just slap a stock card in here, they first stripped off the air cooler and installed a full-cover EKWB waterblock that's capable of cooling the GPU, VRM, and GDDR5 memory on that powerful card. The card's block features a black acetyl back plate, a clear acrylic face and barb housing, as well as a nickel-plated copper frame that rapidly draws heat away from the surface components. A similar block is installed over the Intel Core i7-6700K. Flexible clear tubing, EKWB's 40mm thick CoolStream 240 PE radiator, and the aforementioned reservoir/pump unit loaded up with blue coolant rounds out the custom loop. The barbs and clamps

have all been painted white, which creates a nice contrast in the AION MARS' all-black interior, especially with

the system lit up and running. A 16GB kit of GeIL's SUPER LUCE DDR4-2400 memory also adds a pleasant blue glow to the case's interior.

A major reason one might purchase a fully tricked-out PC from a company like Altex is to avoid the hassle and stress of installing a custom loop, but there's plenty of hassle and stress involved in maintaining such a setup, right? No, thanks to Altex' hassle-free warranty. "[Periodic flush/refill maintenance] is actually included in the warranty offered with all AION machines and upgraded options." Altex knows how big a role temperatures play in the performance of a liquid cooling system, and consequently they recommend users take advantage of this service.

Customer service is important to Altex, and a good buying experience starts with a system that shows up working and continues to run reliably for as long as you need it to. To that end, Altex puts its systems through a series of rigorous tests. "To ensure quality we run a number of full system diagnostics including MemTest, burn-in testing, a 24-hour



The Altex AION MARS looks sharp in blue. The system we examined has EKWB waterblocks for the graphics card and CPU, flexible clear tubing, and EK's 40mm thick CoolStream 240 PE radiator.



Take a look at the back of the AION MARS chassis and you can see that there's a whole lot o' I/O available on this Mini-ITX beast.

leak test on the loop, and since these are for gamers, we push the system and run Furmark and Fire Strike. We provide all the scores in the system documentation with every system." Couvertier emphasizes that Altex holds itself to a lofty standard in the industry, offering a 30-day 100% satisfaction guarantee on its systems, or your money back, no questions asked. "In this age, it's all about quality, and from the parts to the cables, we make sure [our systems] always give the best performance."

See For Yourself

It's easy for a compact PC to talk a big game, but ultimately suffer in the benchmarks due to the compromises that had to be made. As you can see from the benchmark chart, that is not the case for the Altex AION MARS.

Any synthetic benchmark that favors quad-channel memory bandwidth and

the brute force of an eight-core processor will generally perform better on an X99-based platform. But for gamers, all that performance is unnecessary.

When it comes to most real-world tasks, however, the Core i7-6700K is admirable in its ability to multitask and chew through processes. The GTX 980 Ti in this system is also one of the best graphics cards you can buy for 4K gaming. As such, this system scored better than 44fps in both Metro: Last Light and Dying Light, and a still very impressive 35.38fps in The Witcher 3, with the settings nearly maxed out (sorry, no HairWorks).

The Altex AION MARS, backed by customer service that truly gets gamers, packs quite a punch for those looking for a LAN-portable PC that breathes some serious fire in even the most demanding games available.

BY ANDREW LEIBMAN

Benchmark Scores	Altex AION Mars		
3DMark Professional (Fire Strike Extreme) Score	7595		
PC Mark 8 Creative Score	5930		
SiSoftware Sandra 2015 Processor Arithmetic			
Dhrystone Integer Native AVX2 (GIPS)	193.7		
Whetstone Single-Float Native AVX (GFLOPS)	109.1		
Multi-Media Integer x32 AVX2 (Mpixels per second)	394.46		
Multi-Media Single-Float x16 FMA (Mpixels per second)	388.62		
Multi-Media Double-Float x8 FMA (Mpixels per second)	254.09		
Multi-Media Quad-Float x2 FMA (Mpixels per second)	10.35		
Integer Memory Bandwidth B/F AVX2/256 (GBps)	26		
Floating Memory Bandwidth B/F FMA/256 (GBps)	26.45		
Cinebench 15 CPU Score	881		
CrystalDiskMark 5.0.2 (MBps)			
Sequential Q32 T1 Read	556		
Sequential Q32 T1 Write	526.4		
4KiB Random Q32 T1 Read	356.9		
4KiB Random Q32 T1 Write	349.9		
Sequential Read, Write	499, 484.5		
4KiB Random Read, Write	32.12, 129.3		
POV-Ray 3.7 Beta (pixels per second)	1898.22		
Unigine Heaven 4.0 Score	1951		
FPS	77.4		
Games	4K (3,840 x 2,160)		
Metro: Last Light (Very High, 16xAF; SSAA off)	44.33		
Dying Light (High, AO On, AA On, Vsync Off)	44.8		
Witcher 3: Wild Hunt (Vsync Off, Unl. FPS, Ultra)	35.38		

Specs: Intel Core i7-6700K; Motherboard: GIGABYTE GA-Z170N-WIFI; Graphic Card: NVIDIA GeForce GTX 980 Ti; RAM: 16GB GeIL SUPER LUCE DDR4-2400; Storage: 1TB Samsung 850 EVO SSD; 2TB WD Black HDDs (x2); PSU: EVGA SUPERNOVA 750 G2

Make The Best Wired & Wireless Connections

s power users, we spend a lot of time perfecting the performance of our PCs. From fine-tuned overclocks to proper airflow and meticulous cable management, you might devote weeks to system optimization. But how long have you spent refining your home network? Did you just plunk down a wireless router and insert in all the necessary cables? With online access a critical element of so many modern games, a poor home network can cripple your gaming experience as much as any underpowered component. And it's more than just games, as a steady connection is just as important for streaming video. It's also likely that you have a few mobile devices around the house, and a strong wireless signal is important for them, too. Here, we'll examine what it takes to build an elite home network.

Wired Is Still Best

Wi-Fi standards have gotten much faster over the last few years, and the latest standard, 802.11ac, can deliver a theoretical bandwidth of several gigabits per second. We found many currently available 802.11ac routers, for instance, can reach peak speeds of 1,733Mbps over the 5GHz band. These numbers, of course, are theoretical and recorded in ideal lab conditions. In a home environment filled with lots of potential signal interference, the actual speed you'll experience over Wi-Fi is usually only a couple hundred Megabits per second.

There are a couple of reasons for the wide disparity between the theoretical and actual wireless speeds. To start, wireless transmissions include a bunch



of overhead information, such as data about the IEEE standard being used and ACK (Acknowledgement) packets, which takes up around 50% of the total data rate. That means you're already starting off at a rate well below the advertised number before you take into account signal deterioration from distance, wall materials, and interference from other wireless devices.

Signal interference can play a huge role in the actual speed of your connection. Just a few common signal blocking materials in modern homes include foil insulation, metal ductwork, and imbedded metal lath that can reflect signals—creating near Faraday cages in some rooms. The nature of Wi-Fi makes it hard to predict just how much less throughput you'll see, but in general, you're lucky to get one-third of the theoretical data rate.

The 802.11ac standard helps avoid some signal interface, as its biggest bandwidth pipelines shift from the 2.4GHz band to the 5GHz band that's less crowded by Bluetooth signals, garage door openers, baby monitors, and cordless phones (you might not have one, but your neighbor might). The 2.4GHz waveband is still supported, as well, so you can still connect 802.11b/g/n devices. 802.11ac is also designed for better range, as it supports more antennas and can better direct the signal to the intended device.

Certainly, 802.11ac is faster than 802.11n, but there's still a ways to go before wireless reaches the speed and reliability of a wired Gigabit Ethernet connection. Ethernet has to deal with little of the overhead concerns that wireless communications must overcome, so you data transmits at much closer to the Gigabit Ethernet speed found on most current routers and desktop PC NICs. With a wired connection, you also don't have to worry too much about interference, so the near 1Gbps data rate is much more reliable than a wireless connection where data might bump into other signals that keep it from reaching your devices 100% of the time.

Let's Get Practical

Running Ethernet cable across a room is easy enough, but going through walls and floors isn't always possible. And even if you can, routing Ethernet cables through studs, floor joists, and up walls is time consuming and difficult, especially in tight corners where walls are closed up. We won't even get into perfectly fixing spots in the wall where you had to break through and finding a match for the touch-up paint.

Wireless, of course, is a fine alternative for situations where wired cables won't easily reach. We also imagine that you have a few devices, such as tablets and



Many of D-Link's new 802.11ac routers, such as the DIR895L/R seen here, support beamforming, which D-Link calls Advanced AC Smartbeam.

smartphones, that only access your network via Wi-Fi. It behooves you to make certain there are no Wi-Fi dead spots. One of the best ways to avoid



The ASUS RT-AC87U is one of the first routers to support MU-MIMO.

issues is to locate the router in a place where there are the fewest number of obstructions among transceivers. If possible, don't locate the wireless router in a corner of your home, because the signal only has so much reliable range.

Let's say that inside your dwelling, you've discovered that your devices receive full signal up to 25 feet away. If your house happens to fall into the rectangular ranch-style pattern, the 25foot range might mean that putting the router in one corner would prevent the signal from consistently reaching rooms at the far end of the house. Similarly, you won't want to put the wireless router in the basement of a house that's three stories tall. A central location maximizes your coverage area and helps to provide a more consistent connection.

Unfortunately, you might be limited in where the router can be located. As an example, we've been in a house where the old, poor telephone wiring meant that the basement—the point where the DSL broadband entered the house-was the only option for locating the DSL modem

and router. Sure, the owners could have moved the router to a floor above and run Ethernet cable through the floor to connect the modem and router, but this would require drilling up through the floorboards and carpet. In cases like this, there are plenty of good alternatives.

First off, you might be able to replace your router's antenna with high-gain antennas. Some replacement antennas are also directional, so the router can more exactly guide the signal toward your PCs and mobile devices. You might also consider adding a wireless range extender, also known as a wireless repeater. These little devices bridge the gap when the distance between your router and connected devices is too long for a reliable connection. In practice, wireless range extenders work by rebroadcasting the wireless signal, so the device has the same SSID and all of the network management is done by the router.

If you have an old wireless router around the house, it might be possible to turn it into an access point and extend your network's range. In general, this involves entering the old router's settings and matching the current router's SSID,

WPA settings, and encryption type. You'll also need to disable the old router's DHCP server capabilities. The trade-off, when using an old router as an access point, is that the signal speed will be limited by the old router's hardware. Any devices that connect to, for example, a repurposed 802.11n router, would be limited to 802.11n speeds.

The erratic nature of Wi-Fi connections make them less than ideal for gaming and streaming duties. If you absolutely require a steady connection-and don't want to run Ethernet to a PC-powerline networking is an excellent solution. These devices connect to an existing outlet and send network data over the power lines in your house. You'll want a powerline networking kit to get started, as two powerline adapters are necessary to make the network bridge.

Powerline networks are extremely easy to setup. Plug one of the powerline adapters into the wall outlet near your router and run an Ethernet cable from the adapter to one of the router's Ethernet ports. Next, plug the second adapter into a wall outlet near the

device you want to add to the network and connect the adapter to the device's Ethernet port. Typically, the network devices immediately find each other, but sometimes, you might need to press a Connect button on the adapters.

There are a couple of big advantages with powerline networking. First off, powerline delivers reliability close to what you see with a wired connection without having to snake cables across the floor or under carpet. Powerline adapters are quite discrete, and because a PC, game console, or smart TV is likely also near a power outlet, it's often a short cable run to the device. And because it's literally plug and play, you won't need to configure anything on the devices you connect to.

Similar to theoretical wireless speeds, real-world powerline network speeds are much different than the published numbers. Powerline speed can be affected by the quality of electrical wiring, total distance the signal must travel, and noise from electronics with a big power draw, among others. The signal degradation means that, similar to wireless, you're lucky to see a third of the adapter's rated speed. That being said, the throughput you receive is likely to be more consistent than the ebb and flow of a wireless connection.

Manage Bandwidth

Although many new routers come with QoS (Quality of Service) features that give streaming and gaming packets priority over others, QoS alone is not always able to ensure bandwidthdemanding applications get the speed they need. Fortunately, many new motherboards (including mid-range and below models) now come with software that will help to manage the bandwidth over the onboard NIC. GIGABYTE's GA-Z170X-UD5, for example, comes with two Intel Gigabit LAN ports whose traffic you can manage with the included cFos Speed utility.

By default, cFos Speed automatically shapes traffic to help maintain low ping times for better responsiveness with priority



NETGEAR's Nighthawk X8 AC5300 Smart WiFi Router supports a total of up to 5.3Gbps of bandwidth over three frequency bands.

programs, such as games and multimedia playback software. Manual control is also available, should you wish to assign priority among your PC's applications and games. Select ASUS motherboards also use cFos Speed's traffic shaping via the Turbo LAN utility. With ASUS Turbo LAN, there's a real-time speed monitor (for both downloads and uploads), and you can set speed priority levels for each program on your computer. There's also an Advanced mode for those who want to tweak individual network settings.

Another popular traffic shaping utility is Killer's Network Manager, which is available on many MSI and GIGABYTE motherboards featuring a Killer NIC. The E2400 Gigabyte Ethernet controller is Killer's latest NIC, and it features Advanced Stream Detect 2.0 that automatically gives network traffic for online games, HD Video, and streaming websites priority over band ground network activity, such as Windows updates and antimalware updates. Network Manager includes a Visual Bandwidth Control feature that displays which application and websites use up the most bandwidth on your PC, so you can adjust profiles and optimize performance.

An Elite Router

Thus far, we've given you a general blueprint of how to maximize network performance when using wired and wireless signals. But what about the devices themselves? Let's start with the router, as it's the brains of the network. Clearly, users who want the fastest wireless speeds will want an 802.11ac router, as the standard offers four times the bandwidth of most 802.11n routers.

For a consistent wireless signal, 802.11ac provides support for beamforming, which is a feature that helps concentrate wireless signals to the intended

Secure The Network Like An IT Professional

We expect that you use some type of encryption on your wireless network, as no one wants freeloaders using up valuable bandwidth, and of course, we want to protect the network from nefarious types. WPA2 (Wi-Fi Protected Access version 2) is still the strongest protocol widely available and has been so for more than 10 years. Some routers might support WPA2 Enterprise, and while the Enterprise version is more secure than EPA2, it also requires you to set up a RADIUS server or sign up for a hosted RADIUS service. WEP (Wired Equivalent Privacy) is the least secure option, as even novice hackers can use publicly available key cracking software to break the code.

If you aren't using any encryption, now is the time to set it up. To start, enter your router's settings and provide the username and password. Next, find and select the wireless network setup area. Under an encryption or security section, select WPA2 and enter the password you wish to use. You may also see options for AES (Advanced Encryption Standard), TKIP (Temporal Key Integrity Protocol), or both. AES is the stronger of the two types, and most modern devices support it. TKIP should only be used if you have legacy devices that require it.

There are several other techniques that will keep your average Joe at bay, yet aren't a real deterrent for determined hackers. For example, you can hide your SSID (Service Set Identifier) broadcast, so its name won't show up in a regular Wi-Fi scan. But freely available wireless network analyzers can bring up the SSID with relative ease. Often, these tools also include a MAC (Media Access Control) address identifier to overcome setups where you've allowed only certain MAC addresses on your network. Once they've detected the MAC address filters, a hacker could change the MAC address on their PC to match one in the allowed list.

A more useful tip to protect your router and other edge devices, such as an IP camera or NAS, is to change the login and password from the default option. This way, possible network intruders can't look up the standard login settings and enter your network through these devices. You should also keep the firmware on your router and edge devices up-to-date, because wireless device manufacturers sometimes release new firmware that resolves exposed vulnerabilities. In some cases, the new firmware might also provide you with new features.

Another good idea is to disable remote administration—assuming you never plan on remotely viewing or changing your router settings. By disabling the remote access features, the router can only be managed by computers that are directly connected to the router, which should help to prevent hackers that wirelessly break into the network from making changes.



For home network security, it's best to use WPA2 and AES encryption.



The PowerLine AV2 2000 kit from D-Link supports up to 2,000Mbps of network throughput.

device, rather than sending the signal out in all directions. Technically, beamforming was available with 802.11n, yet the standard was not clearly defined and most implementations were proprietary, so interoperability was difficult to do. With 802.11ac, the Wi-Fi Alliance defines the beamforming standard, so interoperability won't be an issue.

For beamforming to work, both your router and the host device must support it. Not all 802.11ac routers support beamforming, though many released in the last year do. Even fewer devices currently support it, but we expect that to change in the near future. Manufacturers might also label beamforming differently. D-Link, for example, calls it Advanced AC SmartBeam, and you'll find the feature in many of D-Link's higher-end models, including the DIR-895L/R, DIR-890L/R, DIR-880L.

Another big development with 802.11ac is MU-MIMO (Multi-User, Multiple Input, Multiple Output). You might remember MIMO as a hyped feature with 802.11n, as it splits data into spatial streams for transmission to and from multiple antennas. MIMO improves data rates and lowers latency, but 802.11n's MIMO can only serve one device at a time. MU-MIMO delivers more effective bandwidth per device, because the split spatial streams can be routed to multiple clients at the same time, meaning that devices won't have to wait their turn to receive data. A recent study claims that MU-MIMO can triple Wi-Fi performance.)

Similar to beamforming, MU-MIMO must be supported on both your router and devices. MU-MIMO is a relatively new feature and there are only a few routers that support MU-MIMO it. One model is the ASUS RT-AC87U, which provides a dualband data rate of 2334Mbps (600Mbps

over 2.4GHz, 1734Mbps over 5GHz). The RT-AC87U features a four-antenna design that allows for four simultaneous MU-MIMO streams. It also supports ASUS' AiRadar beamforming for efficient throughput. Only a handful of current devices support MU-MIMO, but because MU-MIMO has such performanceenhancing potential, it'd be a good feature for power users to look for if they want to futureproof their network.

If you want to guarantee the upmost speed, look for 802.11ac routers that dole out network traffic over three wireless bands. NETGEAR's Nighthawk X8 AC5300 Smart WiFi Router supports up to 5.3Gbps of bandwidth, split among one 1000Mbps 2.4GHz band, one 2166Mbps 5GHz band, and a second 2166Mbps 5GHz band. The Nighthawk X8 AC5300 Smart WiFi router will also analyze and intelligently assign devices to the fastest available Wi-Fi band. And over the 5GHz band, load balancing is used to ensure traffic will be split over devices connected to the 5GHz signal. The X8 AC5300 Smart WiFi Router is MU-MIMO capable, as well, and comes with NETGEAR's Active Antennas to boost range.



The EA-AC87 from ASUS is an 802.11ac access point that can help to extend your network, as well as pass along MU-MIMO spatial streams.



NETGEAR's ReadyNAS lineup of network-attached storage products make it easy to share files with all kinds of devices over your home network.

Extend Your Network

A powerful wireless router is a good start, but serious gamers probably won't risk a wireless connection with online games. If you'd rather not run a wire to your gaming rig, try out a speedy powerline networking kit. D-Link's PowerLine AV2 2000 is a set of adapters delivering a theoretical throughput of 2000Mbps. The kit also supports 128-bit AES link encryption, for assured security, and MIMO technology, so the powerline adapters can exchange multiple streams of data over your home's wiring. D-Link indicates that MIMO is ideal for 4K video streaming across your network.

If you're looking to a way to have "five bars" of connectivity in all rooms and 802.11ac speeds, it's wise to invest in an access point or range extender. ASUS EA-AC87 is an access point that extends the 5GHz band at up to 1,734Mbps, ideal for lag free multimedia playback. The EA-AC87 has four antennas and supports MU-MIMO technology to pass along four spatial streams at one time (when devices that can handle MU-MIMO become readily available). If you're looking to add a 5GHz band to your network, the EA-AC87 can even pair with a single band

2.4GHz router to upgrade the network, while keeping your existing router.

Network Storage

As our personal collections of images, videos, and music have expanded, the need for local storage has grown. And ideally, we'd like to have access to our digital collections from every device on the network. Adding a NAS (Network Attached Storage) device to your network is perfect for sharing files.

NETGEAR's ReadyNAS 212 is a 2-bay NAS that supports up to 12TB of storage, and it supports HD media streaming to multiple devices. For example, the ReadyNAS 212 includes a 1.4GHz quad core processor that accelerates read/ writes and can handle 1080p real-time transcoding. Other features include multi-folder backup, including automatic backup via the supported ReadyCLOUD app. It supports backup via PC, Mac, smartphones, and tablets. NETGEAR also offers a ReadyNAS 214 model that supports four hard drives and up to 24TB.

DIY Security

IP cameras make it easy to monitor your home. Whether you want to improve home security, keep a watchful eye on the kids (or baby), or just see what the dog is up to, IP cameras provide affordable surveillance. The greater range and better speed of 802.11ac is ideal for the video feeds of IP cameras, too. D-Link's DCS-935L is a Wi-Fi camera that supports 802.11ac and 720p HD video quality. The DCS-935L is night-vision capable, too, and delivers visibility up to 16 feet in total darkness. For security purposes, the DSC-935L supports both motion and sound detection, and it will push any alerts to your phone, where you can remotely check on the problem on your mobile devices via the mydlink Home app.







The D-Link DCS-935L Wif-Fi camera supports 802.11ac connectivity and delivers 720p video quality.

Q&A With Bill Owen

Mnpctech's "Overkill Bill" Checks In

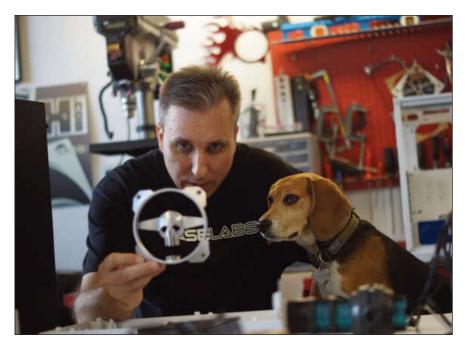
: Hi Bill, nice to chat with you again. For starters, can you talk a little bit about how you got into modding in the first place? Your work has inspired a lot of folks to get involved with modding, but as they say, everyone has to start somewhere, right? And when did you decide that you wanted to turn your hobby into a business and start Mnpctech?

Bill: Originally, I was an avid car hobbyist and tuner. I quickly learned it's easier to build PCs on a workbench than lying under a car on a cold garage floor. My first case mod was inspired by a car in 1999. My friend wanted his gaming PC modified as a tribute to his Volkswagen GTI. I used components I found at a junkyard that included a door handle (later became a carry handle on the top), a VDO voltmeter from the center console, and the switch for the headlights. I also painted the case using the same Tornado Red that his GTI got in the factory. I titled it "Dell Eater."

I went onto customizing other cases for people and launched Mnpctech.com in 2001. The majority of the custom PCs I build now are used for giveaways, trade shows, or marketing hardware or games for



Bill's current "Star Trek"-themed project.



Bill in his workshop with his assistant Dixie. (Photo courtesy of A. Owen.)

commercial clients. This is a very small and exclusive portion of my business now. My focus has shifted more on manufacturing custom case accessories and consulting for other manufacturers.

: What was the modding scene like when you got started, and were custom parts available like they are today, or were you pretty much on your own?

Bill: The scene was focused a lot more on DIY when I started in 1999. I miss those days of having to experiment with different cooling techniques and theories. I witnessed the first CPU waterblocks and Phase-Change coolers when people created them in the garage. The first LED cooling fans and screaming 60mm CPU fans. Everyone into PC building owned or debated

about buying a Chieftec Dragon full tower. I remember the power invertors for cold-cathode light kits igniting on fire. Today's builders are spoiled. Nobody could have predicted having the choice of red compression fittings from four different manufacturers.

: Can you tell us about your current project? What inspired you to start it, and what are your plans for it?

Bill: I'm working on my see:
Trek"-themed build. The first was : I'm working on my second "Star for David Gerrold, a writer for the original series. This one is for a client who was injured in Afghanistan while serving our country. It will include a tribute to Leonard Nimoy and combine graphics and some mod ideas inspired by the original series and "Star Trek: TNG."

: Of all the mods you've created over the years, what would you say are your top three favorites, and why?

Bill: One is the Blade Runner tribute mod I did for NZXT; I need to ask them if I can get or buy it back. Another of my top three is my Firefly tribute for Corsair. I don't think they will ever sell that one. Also, my Phenom PC for AMD. Nobody knows where it is—the rumor is somebody stole it from AMD.

: What is the handiest tool in your shop, and why?

Bill: Hand file. Simple and effective.

: Speaking of tools, aside from big industrial stuff, what tools would you say that no modder should be without?

Bill: Ruler, pencil, masking tape, safety glasses, rotary tool, and jigsaw. Invest in a 24-volt cordless power drill and a variety of specialty drill bits for metal and plastic. You'll also want hole saw attachments for adding cable, liquid tubing or cooling fan holes. If you think you'll be in this hobby for the long haul, invest in a 14-inch or larger vertical or scroll saw with a fence attachment for cutting raw material sheets like metals, acrylics, or plastics.

: What is your least favorite part of modding a PC? Is there anything that you just have to grit your teeth and power through?

Bill: Sleeving cables. It consumes a great deal of time. Last time I sleeved a PSU, I did it while consecutively watching the entire "Planet of the Apes" DVD collection.

: What advice would you give someone who is interested in getting into modding but has no idea where to start?

Bill: Find a junked or cheap PC or case on Craigslist or Recycler. Take the proper safety precautions and



Bill's custom Deepcool Tristellar mod, which is available at <u>Newegg.com</u> on a limited basis.



Here's a look at Bill's take on Fractal Design's Define S.



Bill's "Blade Runner" tribute mod, based on an NZXT Switch 810.

make a window in the side panel or add more or larger cooling fans. Surf Google images for inspiration: Just enter the words "case mod" or "PC mods," and you'll see thousands of builds over the past decade. If you need advice or help, join <a href="https://doi.org/10.1001/join.2001/joi

Q: OK, now it's time for Five Quick Questions!

1) AMD or NVIDIA?

Red Team! I had to scold NVIDIA on Twitter recently for not crediting builders on the custom PC photos the company posted on Instagram.

2) Coke or Pepsi?

What is more American than ice-cold Classic Coke in a bottle?

3) DC or Marvel?

That's pitting Iron Man against Batman, and Tony Stark has more cool tech then Bruce Wayne, so Marvel!

4) Kirk or Picard?

Only Picard could pull off "I am Locutus of Borg," but more people quote Captain Kirk's "Khaaan!!!" so Kirk wins.

5) Counter-Strike or League of Legends?

Has Counter-Strike ever filled a public stadium with fans? League of Legends.

: Thanks for your time, Bill!

Bill: Thank you to *CPU* magazine for continuing to support custom PC building. I want to support *CPU*'s readers by offering a 10% discount off the total for any Mnpctech.com order placed up until January 1st, 2016. Just enter "CPUMAGAZINE" at checkout in the "Gift Certificate or Promo Code" box found in your order summary. (U.S. domestic orders only, please.)

COU. IS MOD CENTRAL

If you love great mods, *CPU* is the place for even more coverage of the latest mods, the greatest modders, and mod contest winners from all over. In these pages, you'll find modified stock cases, custom builds,



And if you have a mod you want to share with the world, drop us a line and let us know at <a href="mailto:m

Each month, one modder's work will show up on the cover and in the monthly "Mad Reader Mod" feature. If it's yours, you will win a cool \$1,500—and massive bragging rights.

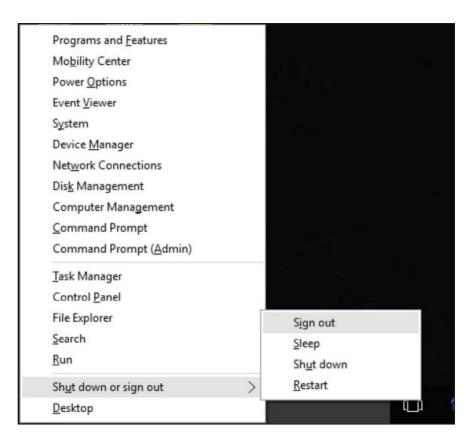
Windows 10 Shortcuts

Now that you've successfully installed Windows 10, it's time to shift your attention to how to get Microsoft's new operating system working in your favor. In this article, we'll walk you through some of the new operating system's most useful shortcuts for navigating the new interface, accomplishing common tasks, and shaving seconds off most of the things you do with your PC.

Windows Key Shortcuts

Microsoft's operating systems have always shipped with some built-in keyboard shortcuts that use the Windows key, and Win10 is no exception. To execute the following shortcuts, just press and hold the Windows key, followed by the appropriate character key or keys. In some instances, you can continue to hold the Windows key while pressing the latter half of the combo repeatedly to perform the function and undo it. (NOTE: Many of these shortcuts are carryovers from Win8/8.1 and earlier, but some of your old favorites may no longer work.)

Windows + X. As one of the most powerful shortcuts from Win8/8.1, this shortcut is back and even better in Win10. It brings up a menu in the lower left of the Desktop that lets you quickly access items such as the Event Viewer, Device Manager, Command Prompt, Task Manager, Control Panel, Run dialog box, and Desktop. You can also quickly sign out, shut down, restart, or put your PC to sleep using the appropriate submenu toward the bottom of the list. We also like that there's a dedicated Command Prompt (Admin) option, which launches the elevated version of Cmd.exe.

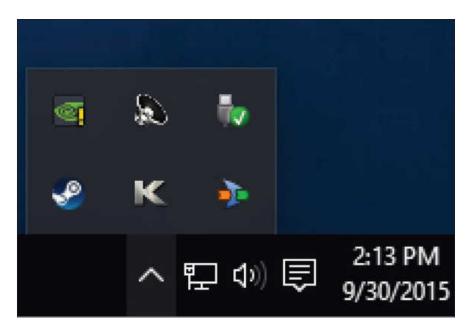


Pressing the Windows key + X gives you a slew of handy shortcuts in Windows 10.

Windows + E. This shortcut launches the Windows File Explorer, making it easy to locate files on your computer, hard drives, or network location. In Win10, File Explorer loads the Quick Access view by default, which displays a series of frequent folders followed by a list of recent files. Of course, the familiar file tree resides on the left pane of the window, letting you quickly navigate to the location you desire should it not appear among the frequent folders and recent files.

Windows + A. Microsoft is continually evolving the way its OSes display notifications, and with the rise of

social media and the increasing mobility of PCs, keeping up with these events is more important than ever. As such, Win10's Action Center pops up when you perform this shortcut and takes up a sizeable column along the right edge of the screen. Here you'll find the security and maintenance messages that Win8's Action Center focused on, but the Action Center also now displays a handful of quick-access functions, such as All Settings, Location, Quiet Hours, VPN, Note, and more. Toward the top of the column, you'll find notices of recently installed updates, application sync issues, calendar appointments,



Quickly navigating to the hidden icons menu using a key combo can be a real time-saver.

social media events, and more. As you might imagine, the more personal details and application integration you allow Win10 to tap into, the more useful the Action Center will become.

Windows + B. Most of the shortcuts we talk about in this article launch



The Project pane lets you tweak how your system handles multiple displays.

applications or quickly take you somewhere, but you might not notice anything after performing the Windows + *B* shortcut. This one simply highlights the notifications area on the Taskbar, making it easy to access the hidden icons by simply pressing the ENTER key and navigating them using the arrow keys. Pressing the down arrow key after performing this shortcut lets you cycle between the shown icons in the notification area.

Windows + K. Performing this shortcut opens the Connect pane on the right edge of the screen and initiates a search for Bluetooth or wireless display devices. If you're performing this shortcut, remember to make sure the device you're connecting is powered on and discoverable. If you click the Find Other Types Of Devices hyperlink at the bottom of the pane, you'll open the Devices settings menu. From here, you can add a device, view the currently connected devices and safely disconnect them, enable or disable driver downloads while on metered connections, and access hyperlinks for the Devices And Printers and Device Manager menus.

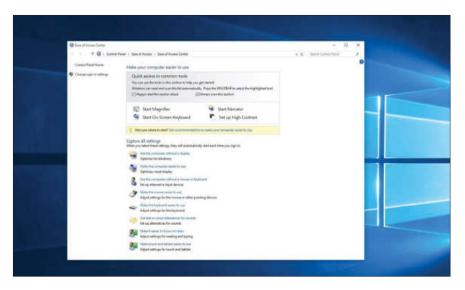
Windows + P. The Project pane, launched by performing this shortcut, is useful for those times when you're juggling the connection with an additional display and/or audio device. The four main options include PC Screen Only (which disables the secondary screen), Duplicate, Extend, and Second Screen Only (which disables the primary screen). If you're trying to set up a wireless display, there's a hyperlink here that opens the Connect pane, as described above.

Windows + L. Stepping away from your computer for a moment? Use this shortcut to sign out and return to the lock screen.

Windows + ENTER. This shortcut launches the Narrator, which is an accessibility utility that reads aloud on-screen text and various events, such as error messages and items that occur as you use the computer. The Narrator also comes with a laundry list of its own shortcuts you can use to get the utility to read specific items. For instance, to get the Narrator to read the currently highlighted item, just press CTRL + SHIFT + ENTER. To hear the text contained in an entire window, press CTRL + SHIFT



The Narrator is very beneficial for blind or visually-impaired users.



The Ease Of Access Center is where you'll go to find all those accessibility options.

+ Spacebar. Press INSERT + F6 to read aloud the current paragraph, press INSERT + F7 to read aloud the current page, and press the CTRL key at any point to stop the utility from reading text.

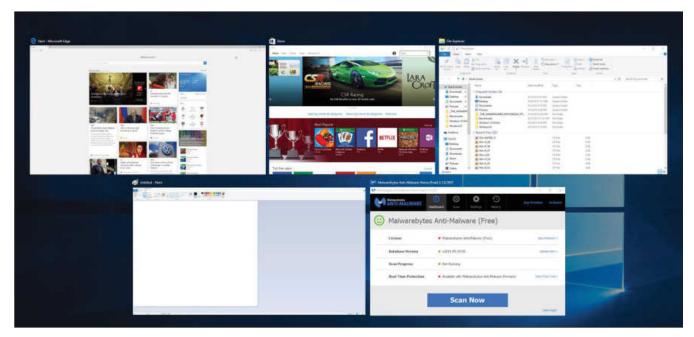
Windows + M & Windows + D. These shortcuts are oldies but goodies: they both minimize all open windows, which is good for those times when you

need to access an item or shortcut from the Desktop. The difference between the two is that the Windows + M shortcut isn't reversible, while the Windows + D shortcut is. That means that after initially performing the latter shortcut, you can perform it again (or keep holding the Windows key if you just want a peek at the Desktop) to make those windows reappear.

Windows + U. To quickly bring up the Ease Of Access Center, perform this shortcut. The top portion of the EOAC collects a quartet of utilities that were commonly found in the accessibility menu of previous operating systems, including the Magnifier, Narrator, On-Screen Keyboard, and High Contrast display settings. Click any of the items to launch the respective utility or scroll down to view other settings, such as Use The Computer Without A Display, Make The Computer Easier To See, Use The Computer Without A Mouse Or Keyboard, and Make Touch And Tablets Easier To Use. On the left side of the window, you can also access the Change Sign-In Settings to alter when certain accessibility features start.

Windows + TAB. Perform this shortcut to open the Task View, which temporarily displays all open applications, documents, and folders on the Desktop so you can click the one you want to switch to.

Windows + O. If you're using Win10 on a phone, tablet, or convertible mobile device, this handy shortcut lets you lock orientation to



The Windows key + TAB shortcut lets you view every open application window at once.

keep from inadvertently rotating your screen if you tilt it too much in one direction or another.

Windows + R. The ever-useful Run dialog lets you execute commands and launch programs without having to double-click a shortcut or hunt for the application executable. Just perform this shortcut and begin typing. Press ENTER to launch the utility into action.

Windows + (Plus Sign) & Windows + (Minus Sign). This function opens the Magnifier utility and alternately zooms in and out of the display around the mouse pointer. To move the viewable area around when zoomed in, just move the mouse pointer in the direction you want to view.

Windows + PRNT SCRN. This is a useful shortcut that automatically snaps a screen shot, saves it as a PNG, and then drops it into the C:\\This PC\ Pictures\Screenshots folder. You can also conveniently capture screen shots in games this way.

Out With The Old

Because of the changes that Microsoft made to the OS between Win8/8.1 and Win10, some of the keyboard shortcuts you enjoyed on the former OS will no longer operate. Windows + F, for instance, launches Win8/8.1's search utility, but now that all of the automated indexing and search functions in Win10 are fully in Cortana's purview, this shortcut doesn't work in the new OS. Instead, you can use the Windows + S shortcut to open Cortana's search field. Just begin typing to perform your search. With Cortana's search bar active, using the Windows + C command launches Cortana's listening mode, where you can speak queries and have her search the local PC or the Web for answers. Just make sure your mic is properly configured first.

While we're on the topic of Cortana, those who have not disabled the personal assistant in a fit of privacy jitters can make the search function much more useful with a simple settings change. Start by launching Cortana (again, by pressing Windows + S), then type indexing options and press ENTER. Next, click Advanced, click the File Types tab, then click the radio button adjacent to Index Properties and File Contents at the bottom of the dialog box. Clicking OK closes the window and enables Cortana to search through not just file and folder names but also indexes the contents of files and documents, ensuring your searches yield much more useful results.

Two more missing shortcuts include Windows + Q and Windows + W, which are used to launch the search app in Win8, but the former displays results from the apps list first while the latter displays results from the settings menu first.

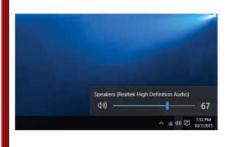
Win10 dispenses with the awkward charms bar that Win8 foisted upon the right side of the screen, and as such the Windows + C shortcut no longer works.

WINDOWS TIP OF THE MONTH:

Reclaim The Old Volume Slider

If you've been using Win10 for a while, you've probably noticed that the volume control slider, which you can bring up by clicking the speaker icon from the notification area, received a significant makeover. The new slider is a horizontal one that lists the current default playback device, along with the controller in parentheses. The old vertical volume control slider features a hyperlink that lets you launch the Volume Mixer, which in turn lets you independently adjust the master volume and system sounds. To reclaim the old volume slider, you need only perform a simple Registry edit.

Start by typing regedit into the search field adjacent to the Start button, then press ENTER. Click Yes to dismiss the User Account Control pop-up, then navigate to HKEY LOCAL_MACHINE\Software\Microsoft\Windows NT\CurrentVersion folder. Right-click the CurrentVersion folder, click New, click Key, name the key MTCUVC, and press ENTER. With the new key highlighted in the left pane, right-click in the open space in the right pane and click New, then DWORD (32-bit) Value. Name it EnableMtcUvc, then press ENTER. Finally, double-click the new DWORD and set the Value to 0. Then just click OK, exit the Registry Editor, and click the speaker icon to see the familiar slider. To restore Win10's horizontal volume control, navigate to the same Registry key and set the value of the DWORD you just created to 1, then exit the Registry Editor.





The volume slider has changed in Windows 10.

Two of the items on this list now have shortcuts of their own, however. To access the Share charm, press Windows + *H*. You can quickly access the frequently useful Settings app by pressing the Windows + *I* shortcut.

Now that Win10 has effectively erased the difference between Win8/8.1's socalled native apps and any other software you use on your PC, some of the associated navigation features no longer Thumbnail views. The other views are still accessible as well, just click View and then choose an option from the Layout section, such as Extra Large Icons, List, Small Icons, and more.

Microsoft's new File Explorer features a number of context menus that only appear if you're viewing a specific type of folder or drive location or have selected a certain file type, such as an audio file, image, or application. These

| Fire Caphone | Fire |

File Explorer has received a number of enhancements since Windows 7.

work. One such action is the old way of grabbing a Win8/8.1 native app at the top of the screen and swiping it to the bottom of the screen to close it.

Do More With File Explorer

If you're making the jump to Win10 from Win7, then you're probably not familiar with the new features Microsoft added to File Explorer as of Win8/8.1. As mentioned above, you can launch it by pressing Windows + E. If the File/Home/Share/View ribbon doesn't appear at the top of the window, you can click the chevron icon from the upper right to expand it and view these helpful menus.

The two icons in the bottom right of the File Explorer window let you quickly switch between Details and Large context menus appear at the top of the Explorer window and let you perform various context-specific actions. These special menu tabs are brightly colored; for instance, the Video Tools tab is pink and the Picture Tools tab is yellow.

Win7 and Win8/8.1's Libraries, or folders that contain all files of a given type such as Music, Documents, and Videos, don't appear by default in Win10. To get these back, launch File Explorer, again by pressing Windows + E, click This PC, then right-click in the open space at the bottom of the left pane (you'll need to make the File Explorer window larger if there's no empty space) and click Show Libraries. For us, the Libraries appeared toward the bottom of the file tree, so we dragged it to the top and pinned

it in among the Quick Access items. When you navigate your Libraries in File Explorer, you'll find a purple Library Tools menu option at the top of the screen. Click Manage to perform various Library-specific tasks such as Set Save Location, Show In Navigation Pane, and Restore Settings.

When you view the contents of the Recycle Bin from File Explorer, you'll have access to the Recycle Bin Tools options. Click Manage under this tab to access functions such as Empty Recycle Bin, Recycle Bin Properties, Restore All Items, and Restore Selected Items.

As with previous operating systems, Microsoft made some file types and folders invisible by default. The C:\\Program Data folder is one such folder hidden by default in Win10. To make these items visible (to perform a range of advanced tasks, for instance), launch File Explorer by pressing the Windows + *E* shortcut, click View, and then put a check mark in the box adjacent to Hidden Items.

Another neat trick you can do from File Explorer in Win10 is optimize (defrag), format, or clean up a storage drive on your PC. Just launch File Explorer and select the drive or This PC from the left pane. This displays the Drive Tools toolbar at the top of the window. Just click Manage to access these handy functions.

Microsoft makes it easy to encrypt files and folders in Win10. Just open File Explorer to navigate to the drive you want to encrypt, click Manage from the top of the window, click BitLocker, and then select Turn On BitLocker. You can also enable BitLocker from the context menu that appears whenever you right-click a drive or location.

File Explorer features a Computer context menu that you can access whenever viewing the This PC folder. The Computer tab is just to the right of the File tab, and it includes a number of Location, Network, and System functions you can perform. The Network functions, for instance, include Access Media, Map Network Drive, and Add A Network Location.











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Upgrades That'll Keep You Humming Along

Is there such a thing as a casual torrenter? We think not, but we'll leave that question to the philosophers. For those of you who are big-time torrenters, we're featuring a pair of programs that should be right in your wheelhouse, FrostWire and Torch Browser. If you're still tweaking and customizing your Windows 10 UI, take a look at Stardock's Start10.

SOFTWARE UPDATES

Coollector Movie Database 4.6.2

We know that lots of hardware enthusiasts tend to also be movie enthusiasts, so having an app that can keep track of all those titles is helpful indeed. Coollector Movie Database does just that. Although version 4.6.2 is a minor update, fixing a bug that caused an infinite loop, two previous versions (4.6.1 and 4.5.9, both released in September) added 1,300 movies and TV series to the software's expansive database and made some underthe-hood improvements to its movie recommendation system.

www.coollector.com

Cybertron Software Privacy Eraser Free 4.4

A must-have if you share your PC with a bunch of freeloaders (or if you are in fact one of said freeloaders), Privacy Eraser Free wipes your presence from web browsers and can do a lot of other handy tasks, too, such as permanently shred files and scrub drives clean. Cybertron releases monthly updates for the software, so much of version 4.4 consists of tweaking this and improving that. Otherwise, the most noteworthy addition is embedded browser cleaning for Thunderbird. The update also fixes a handful of unspecified minor bugs.

www.cybertronsoft.com

FrostWire 6.1.5

Remember LimeWire, the P2P file sharing program that was incredibly popular before a federal judge dropped the banhammer in 2010? FrostWire started in 2005 as an open-source fork of LimeWire, and it's grown up to become a pretty capable client in its own right. (FrostWire's dev team jettisoned LimeWire's original Gnutella core a while back in favor of the BitTorrent protocol.) The biggest update in version 6.1.5 is a revamped HTTP engine; now based on OkHttp, which uses pooled connections, fewer threads, and less memory, FrostWire's search capabilities and cloud downloading should be both faster and more reliable.

www.frostwire.com

Hyperionics HyperSnap 8.06.01

Shortly after celebrating the first birthday of HyperSnap version 8, developer Hyperionics released a pair of updates to its screen capture software. Version 8.06.01 fixes a crash issue exclusive to the 64-bit app that resulted from attempting to save captured text as an RTF. It should also iron out any wrinkles associated with resizing the program's Open and Save As dialog boxes in Windows 10. Released the same day as version 8.06.01, the 8.06.00 update bolsters HyperSnap's compatibility with Win10's multiple desktops feature.

www.hypersnap-dx.com

Stardock Start10 1.02

As we've said before, Win10 rectified a lot of Win8's less desirable UI elements—the Start menu in particular. Win10's Start menu looks and acts much closer to Win7's Start menu, but if you feel like it's not close enough, Stardock's Start10 could be your answer. Since releasing the

app in August, Stardock has released a pair of updates; the most recent makes Start10 suitable for enterprise deployment and fixes some bugs. Previously, version 1.01 added the ability to control the transparency of the Start menu and fixed even more bugs.

www.stardock.com

Torch Browser 42.0.0.10338

Another month of software updates, another Chromium-based web browser that's worth checking out. Torch Browser's claim to fame is its torrenting capabilities, and the latest version makes some major improvements in that arena. Leading the charge is the new Torch Torrent interface, which the developer promises is "easy to use and super fast." There's a new torrent search field, plus Torch Torrent Streaming, which can play files within the browser as they're downloading.

www.torchbrowser.com

DRIVER BAY

Netgear R8500 1.0.0.42

You didn't just drop 400 bucks on a hot-rod router only to neglect to update its firmware when necessary, did you? Of course not, so the most recent firmware for Netgear's blazing fast 802.11ac router is one you definitely want. Aside from improving performance on the 5GHz band in noisy environments, this firmware update fixes issues that cratered throughput under certain circumstances and corrects a problem with IPv6 DHCP mode that caused the router to become unstable.

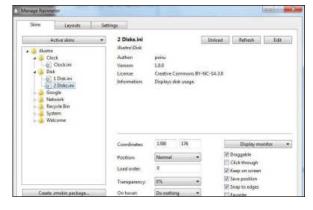
www.netgear.com

Inside The World Of Betas

RAINMETER 3.3 BETA

ower users spend thousands of dollars and hours upon hours to build custom rigs that don't look like an assembly line system. And then what do most of us do? We install a copy of Windows that looks just like the Windows that's installed on millions of other PCs. Sure, there are ways to put your own visual stamp on your OS, changing the desktop wallpaper or using a wacky screen saver, but why not create a visual experience that's on par with the case mods you see every month in our "Mad Reader Mod" article?

Despite its name, Rainmeter is not a weather app. Instead, it's a powerful customization tool that can do a lot more than simply make your desktop look pretty. To make the magic happen, Rainmeter relies on skins, which you can create yourself or download from the impressively large Rainmeter online community. The term "skin" is slightly misleading, since it usually reminds us of the largely cosmetic changes we can make to



Rainmeter 3.3 Beta Publisher and URL: The Rainmeter Team: rainmeter.net ETA: Q1 2016 Why You Should Care: Rainmeter can turn your Windows Desktop into something amazing.

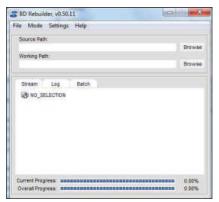
a web browser or media player. "Widget" feels like a better label for what Rainmeter's skins can do, but these are supercharged, supercool widgets. With enough skill, stunning and informative skins are possible.

Of course, acquiring the necessary skill is the catch. Rainmeter isn't built for people to stumble their way through, so we recommend starting with Rainmeter's online manual (docs.rainmeter.net/manual) to claw your way up the software's relatively steep learning curve. If you'd rather not take the DIY approach, then you'll need to turn to that impressively large online community. Sites such as deviantArt, Customize.org, and Reddit all have dedicated space for Rainmeter skins, which you can download and run yourself. ■

BD REBUILDER 0.50.11

omewhere along the way, a lot of media software became really flashy, really bloated, and really expensive. Now, that's not a wholesale indictment of doit-all suites with lots of features and big price tags, but sometimes the best tool for the job is one that does one or two things really well. If you just need to rip your old CD collection or transcode a batch of video files, a one-trick pony can be an unbeatable thoroughbred.

BD Rebuilder is one such horse that belongs in the stables of power users with big Blu-ray collections. Obviously, BDs are massive, which can make archiving a headache. BD Rebuilder steps in and, like an industrial-strength trash compactor, crushes those big files down into something more manageable. It lets you strip away all the superfluous nonsense that just takes up space, such as movie menus, extras, and audio tracks (really,



when was the last time you said, "Wow, I sure am thankful to have that French language track!"?) and can compress the stuff you want to keep down to a DVDsized footprint.

The software has other talents. It can also compress a Blu-ray to MP4, and there are built-in profiles for iPads, iPods, and iPhones. BD Rebuilder also works in BD Rebuilder 0.50.11

Publisher and URL: idobbs softworks:

www.jdobbs.com

Why You Should Care: This powerful tool slims

down fat Blu-ray files.

reverse, in a manner of speaking: It can combine several DVDs to fit in the space of one Blu-ray.

In the spirit of smallness, BD Rebuilder is a portable app that you can easily stash on a USB drive; you should need less than 100MB of space to tote it around. According to the developer, jdobbs softworks, BD Rebuilder does require ffdshow, Haali Media Splitter, and avisynth to be installed alongside the program, but that's a small price to pay for software that's so good at its job.

Mainstream Or Bust

Is Podcasting Poised To Finally Reach Its Potential?

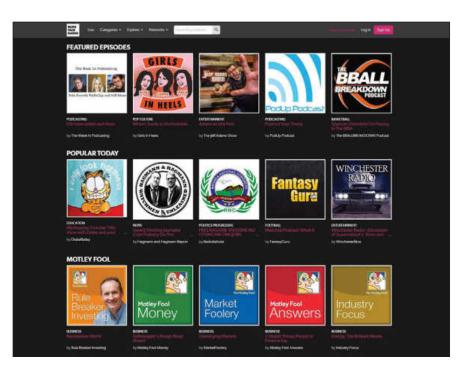
Podcasting has seen its share of ups and downs in the decade or so it has existed. Look into certain recent articles and research, however, and you get the sense that listening to podcasts has become a national pastime in the past year, to the point where everyone now knows what a "podcast" is and is downloading them, where podcasts are kicking that aged relic known as AM/FM radio to the curb, and where we're now living in podcasting "golden days."

Two recent events are commonly submitted as evidence to support such notions. The first is the success of NPR's "Serial," a 12-part podcast series released in 2014 that re-examined the 1999 murder of a Maryland teenage girl and the boy convicted of killing her. "Serial" reportedly averaged 1.5 million listeners per episode at one point and was nearing 100 million downloads as of September.

The second event happened in June when President Obama took a seat in comedian Marc Maron's garage and recorded an episode of a Maron podcast. Within 24 hours, listeners accessed the episode reportedly nearly 750,000 times and within a week had downloaded it nearly 1.7 million times. In a broad sense, a sitting U.S. president appearing on a podcast gave podcasting a degree of credibility it arguably didn't previously possess.

Look beyond these events and the media attention they generated, however, and there's a question of whether everyone really has become a podcast aficionado as is sometimes depicted, or if rather the raft of media attention makes it just seem so. Take, for example, recent data from Edison Research, which has tracked podcasting for 10 years. A survey of 2,000-plus U.S. residents 12 years or older found that just 10% were aware of "Serial" and just 3% had ever listened to it. Additionally, the

There's a question of whether everyone really has become a podcast aficionado as is sometimes depicted, or if rather the raft of media attention makes it just seem so.



BlogTalkRadio is one of several podcast networks now operating. Such networks are consolidating podcast content into one location and handling advertising and sponsorship, distribution, promotion, and other tasks.

percentage who reported having listened to at least one podcast in the past month was 17% (or about 46 million people). Although impressive, that's only up slightly from 15% in 2014, 12% in 2013, 14% in 2012, 12% in both 2011 and 2010, 11% in 2009, and 9% in 2008.

"What I think has happened is the attention paid to podcasting has gone in peaks and valleys," says Tom Webster, vice president of strategy and marketing at Edison Research. We're in a peak presently, which causes attention to rise, but from a listener perspective, growth in podcasting has "really been a long, steady, not spectacular march upward," he says. In other words, consumption is growing each year, but it's not "hockey stick" growth.

Drive Podcast Growth

That said, certain upcoming factors do have the potential to significantly drive podcast growth, including perhaps to mainstream status. These include a growing fleet of both connected automobiles perfectly suited for podcastlistening commuters and smartphones that make accessing and listening to podcasts a breeze. Additionally, new apps and services are putting unique, enticing spins on the podcast experience, and podcast networks that are handling content creation, advertising, fundraising, and other efforts are transforming into well-oiled machines. And lest we forget, the listeners, of which many are young, well-educated, high earning, and

extremely loyal to their shows and hosts. That adds up to podcasts now attracting serious attention and money from sponsors and advertisers.

"Podcasting has always shown a growth curve in the positive direction, and ultimately, I do think it's the way people are going to consume spoken word audio content," says Jay "Pod Vader" Soderberg, former lead producer of ESPN's podcasting division and current head of content for BlogTalkRadio, billed as the largest supplier of podcasts to iTunes. "It just makes sense. You have content that's hyper-focused and is available for when the listener wishes to consume it. If there's anything limiting podcasting, it's discoverability."

For Your Listening Pleasure

Podcast fanatics know that feeling—the one when they discover a great new podcast and have to sing its merits to anyone who will listen. Word of mouth, in fact, still plays a big role in how podcasts are shared and gain audiences. In that vein, we asked for a few recommendations from the people we spoke with for this article.

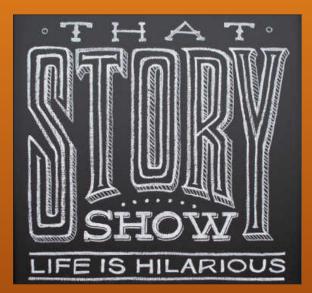
Tom Webster's job as vice president of strategy at Edison Research puts him in the enviable position of getting to "hear so much great content," including NPR's "really, really good" "Hidden Brain," which features "lots of interesting brain science things." As a big sports fan, Webster is also "thrilled" that Bill Simmons is back podcasting and cites Grantland's "Jalen and Jacoby" as something "he really loves."

Jay "Pod Vader" Soderberg, former head of ESPN's podcasting division and current BlogTalkRadio head of content, says although it's unfair to only pick a few suggestions, he nonetheless recommends "No Agenda" from podcasting pioneers Adam Curry and John C. Dvorak; Chris Hardwick's "The Nerdist"; "Rob Has A Podcast" from two-time "Survivor" contestant Rob Cesternino; and his own National Football League-focused "Next Fan Up."

Daniel J. Lewis, host of "The Audacity to Podcast," recommends Erik Fisher's "Beyond The To-Do List" concerning "all aspects of productivity"; James Kennison and John Steinklauber's "That Story Show," which has featured listeners' "hilarious real-life stories" since 2006; and Mignon Fogarty's "Grammar Girl Quick and Dirty Tips For Better Writing."

As senior producer at Midroll Media, Gretta Cohn also listens to numerous podcasts. She recommends shows including "The Black List Table Reads"

where actors read a movie script intended for production and "engineers do really amazing sound design and bring it to life." "Spontaneantion" is a weekly improvised comedy show led by Paul F. Tompkins ("pretty much anything he touches is gold") that involves completely improvised imaginative storytelling, Outside of Midroll, Cohn suggests Gimlet Media's "Reply All," which "features stories about how people shape the Internet and the Internet shapes people," and Radiotopia's "Criminal," which concerns people "who have done wrong, been wronged, or gotten caught somewhere in the middle."



James Kennison and John Steinklauber's "That Story Show" features funny real-life stories.

The ABCs Of Starting A Podcast

So you want to start a podcast but aren't sure where to start. There's no shortage of advice online regarding the microphones, headphones, and other equipment you'll need, as well as for recording and editing content, building an audience through a quality podcast host provider, and effective promotion and presentation. Arguably most important, however, is determining your podcast's focus and providing intriguing content.

"You must be a good curator and presenter of content," says Daniel J. Lewis, host of the "The Audacity to Podcast" and a speaker/consultant on podcasting, "People will come for the content, and they'll stay for the personality. If you can't communicate your message well, few people will stay." Lewis says there are four cornerstones for a great podcast: content (the message), presentation (communicating the content), production (enhancing the content through editing, design, and flow), and promotion (marketing the podcast to grow an audience).

Beginners commonly lack a strong vision for what to talk about and where they're going with their podcast, Lewis says. Additionally, some have poor presentation skills for content or try too hard to replicate someone else's success vs. building their own platform with their own style. If the content, presentation, and production are of high quality but the podcast still isn't succeeding, he says, you may not be targeting the right audience or reaching the right audience in the right way.

Equipment-wise, starting an audio podcast can cost as little as \$200, Lewis says. In addition to a good dynamic USB microphone, he recommends a windscreen or pop filter, a Web host (look for promo codes to save on initial costs), a website creation tool (think WordPress), a service that provides media stats and podcast hosting (again, look for promo codes), and Audacity. For video podcasts, expect more expenses in terms time and money.



Many experts agree the inability to easily discover podcasts is one weakness. As Soderberg says, listeners must find a podcast by either "searching a podcasting app like iTunes or Stitcher or just via a Google search. Then they have to download it, and

depending on how they want to consume it,

have to transfer it to a device that will play it for them. Smartphones make this process a little easier, but clearly more work needs to be done."

When listeners do find podcasts they like, they really like them. "All this talk about shortened attention spans—our attention spans aren't short. We just don't have time for crap," Webster says. Many who discovered "Serial," for example, power-listened to it. "As more compelling content gets produced, that's going to trigger growth into new demographics and growth overall," he says. Ultimately, Webster believes it's inevitable that podcasts will become mainstream. "I think we get caught up in the technology aspect of it. I think eventually 'podcast' is going to become sort of an anachronistic word. Ultimately, they're just shows we want to listen to when and where we want to listen to them, and I don't see why that isn't a mainstream desire," he says.

What's In A Name

As history goes, British journalist Ben Hammersley conjured up the word "podcast" while writing about the burgeoning "experiment" for a 2004 article in The Guardian. Those old enough will remember that, early on, podcast listening wasn't exactly user-friendly for the general masses. Listeners had to find a podcast, subscribe to it, download episodes to iTunes, connect an MP3 player to a computer, and sync the episodes. Still, podcasts caught on. There were reportedly 3,000 available in 2005, and that year, the New Oxford American Dictionary named "podcast" its word of the year. Despite initial success, however, interest ebbed and flowed through the 2000s before essentially flatlining as streaming audio and video services grabbed users' attentions.

Today, much about podcasts has changed, including that Apple no longer sells the original iPod that put the "pod" in "podcast." Instead, we have smartphones, which there will be nearly 200 million users of next year, according to Statista. Smartphones, of course, enable simply firing up an app to automate most of the download process. Edison Research data from May indicates those who consume podcasts do so predominantly via mobile devices (64%) rather than computers (36%). As Alex Blumberg, CEO of podcast network Gimlet Media, told New York Magazine, "now that everyone is walking around with a radio

in their pocket at all times, and now that all cars are going to be connected, the form can flourish again."

Beyond Gimlet Media, a startup that raised about \$1.5 million relatively quickly, podcast networks such as Midroll Media, PodcastOne, BlogTalkRadio, Radiotopia, Earwolf, Wolfpop, Nerdist, and Panoply have formed to develop, produce, host, distribute, and attract advertising dollars to podcasts. Sponsorships and advertising reportedly are thriving, with the CPM (cost to advertiser per 1,000 impressions) for podcasting rating higher than for radio, network television, and Web advertising. One reason why is that podcast sponsors/ advertisers like that it's the podcast hosts who actually read ad spots, thus forming strong, meaningful connections with listeners that translate into sales.

Webster believes podcasts are on the cusp of having serious money invested in them. "We're starting to see brand dollars flow into podcasts, and as soon as that happens, you start to get investments in content," he says. As more mass-appeal content surfaces, more people discover the content, and content investments and brand dollars pick up. Although Webster doesn't expect a year where investments will double or explode ("that's just not how it's worked in the past"), he does believe more compelling content is "absolutely starting to drive growth."

What "Serial" actually did was "start conversations on Madison Avenue," Webster says, in terms of advertisers asking, "What's going on? Is there an audience here? Should we start paying attention?" Further, "Serial" helped move watercooler conversations from people asking "What's a podcast" to "Have you listened to 'Serial?'" Webster says. "Podcasts are now becoming a shared experience, whereas before it was very much 'I have these podcasts I listen to, and they're these little niche interests, and they're for me personally," he says.

Nationally, "Serial" led to Ira Glass, "Serial" producer and "This American Life" creator, appearing on "The Tonight Show," the podcast being featured in a "Saturday Night Live" skit, and it now reportedly

The Tops In Technology

There are reportedly 250,000-plus podcasts in iTunes alone. There's a podcast to match pretty much any taste, including technology. Though selecting just a few of the many stellar tech-related podcasts available is a Herculean task, here's a short list to consider:

- "a16z podcast": From venture capital firm Andreessen Horowitz, a16z tackles tech news
- "Anandtech Podcast": This podcast "gets to the bottom of the latest tech without watering it down."
- "Daily Tech News Show": This podcast from tech veteran Tom Merritt uses a unique "nickela-day" crowdfunding approach to cater to listeners' tastes.
- "Reply All": A top-rated podcast about all things Internet.
- "Rocket": An all-female-hosted podcast featuring weekly "accelerated geek conversation."
- "Spark": Offbeat tech topics galore await, including why your smartphone can't understand your accent.
- "Talking Machines": A "window into the world of machine learning."
- "This Week In Computer Hardware": The latest on mobos, CPUs, GPUs, benchmarks, and more.



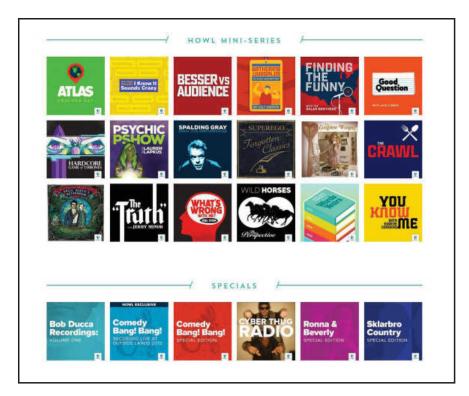
Spark offers an offbeat look at tech.

- "The Vergecast": Touted as the only podcast needed "to make sense of the week in tech news. And your life."
- "What The Tech": Featuring industry vet Paul Thurott, this podcast spotlights new and emerging technologies.

being developed into a cable television show. Soderberg says podcasts need such mainstream attention. "When people can listen to podcasts in their cars like they listen to the radio-and we're closethat's going to change everything. Bigger advertisers getting into the space will also 'legitimize' the medium," he says. "Right now, the biggest spenders in advertising on podcasts are from startup companies, which is great, but as larger corporations start to realize the true value of a podcaster with a captive audience, that will have a big impact on the industry, as well."

There are some hurdles to clear first. For example, while podcasts and streaming audio are making inroads in automobiles, AM/FM radio remains dominant. "That's a dominance that's going to take a while to erode," Webster says. On one hand, when consuming digital audio is easy and frictionless, it's highly consumed. At home, for example, 13- to 34-year-olds spend far more time listening to streaming audio than AM/FM radio. In the car, though, that group looks about the same as other age groups. Edison Research's 2015 data shows 53% of U.S. residents listen to AM/ FM radio nearly all or most of the time in automobiles vs. just 9% for online radio. "There's a pent-up demand for digital audio in the car, but the slowness is due more to how often we buy new cars, which isn't that often," Webster says.

Another hurdle is that there isn't a native Android app for podcasting, and



With its Howl premium service, Midroll Media provides monthly subscribers access to entire remastered archives and special content such as mini-documentaries.

there's a significant difference between Android- and iOS-based audiences. "The podcast was birthed in the iOS ecosystem, or at least in the Mac OS ecosystem, and has been baked into iTunes and now Apple's own native podcast app," Webster says. "That simply hasn't been the case with Google." Many podcast episodes, in fact, conclude with hosts asking listeners to subscribe in the iTunes store. "That's leaving out 50% of the smartphone market," Webster says. "That's something I think will change, and there are certainly rumors that Google is going to bake that into the next round of Android."

The New Age

There are still plenty of podcasters who record their shows from bedrooms, basements, garages, and attics searching for an audience. Increasingly, though, podcast networks are where the action is happening, and heavyweights from other mediums are getting involved. Norm Pattiz, founder of radio titan Westwood

One and hailed as "the founding father of modern audio syndication," for example, founded PodcastOne, the nation's largest advertiser-supported podcast network. PodcastOne houses 200-plus shows from comedians, reality TV stars, pro athletes, and others that deliver reportedly more than 400 million monthly impressions for advertisers. Recently, Hubbard Radio acquired a 30% stake in the network.

Other notable networks include BlogTalkRadio; the journalism-centric Panoply from Slate Media; PRX's (Public Radio Exchange) Radiotopia, home of the ultra-popular "99% Invisible"; and Gimlet Media, which Blumberg launched to build in-house podcasts from the ground up. Blumberg, former producer of "This American Life" and founder of NPR's "Planet Money," hosts his own top-rated "StartUp" podcast documenting how someone lacking a business background starts a business.

Midroll Media is an advertising and content creation network that E.W. Scripps Company recently purchased. Midroll recently launched a Netflix-like premium subscription service called Howl that grants access to special content and remastered archives for \$4.99 a month. Notably, Midroll is the parent company of the popular comedy-driven Earwolf and Wolfpop networks. Gretta Cohn, Midroll Media senior producer, describes Howl as somewhere Earwolf and Wolfpop listeners can gather and "a way to bring all our things under one roof and invite other people to be there with us." Among the special content offered are original mini-series created just for subscribers.

"What's great is a lot of the folks who have weekly podcasts have stepped outside of that role and tried new things," Cohn says. For example, the Sklar Brothers host a weekly sports-themed "Sklarbro Country" podcast for Earwolf but also perform standup on weekends around the country. With "Finding The

Increasingly, podcast networks are where the action is happening, and heavyweights from other mediums are getting involved.

In The Producer's Chair

Listen to an episode of "This American Life," "Criminal," "99% Invisible," or "Radio Lab," and it's obvious that hours of development, research, writing, editing, and other production works are poured into even one episode. Gretta Cohn knows this firsthand. Before becoming senior producer at Midroll Media, parent company to the popular Earwolf and Wolfpop podcast networks, she was a producer for "Freakonomics Radio" and WNYC's "Soundcheck" and worked on such public radio shows as "Studio 360," "The Story," "Word of Mouth," and "Re:Sound."

Cohn cites three major aspects to her producer position at Midroll. The first is helping Midroll's owned and operated podcasts grow, providing hosts feedback, and discussing ideas. The second is piloting new content. Historically, the Los Angeles-based Midroll has had great access to the city's "incredible pool of comedic

talent," Cohn says. At a newer office in New York, however, Cohn is helping pilot, prepare, and tweak new podcasts featuring New York-based talent. The third and primary aspect of Cohn's job now is working on Midroll's new Howl premium service, which provides monthly subscribers access to all archives from Earwolf and Wolfpop podcasts and other Midroll-linked shows. Among other things, Cohn commissions content, hears pitches and picks promising ones, and develops content with others for the Howl app.



Gretta Cohn knows firsthand the research, writing, and more that goes into a podcast.

A producer's role largely depends

on the podcast, Cohn says. "A lot of comedy shows don't have particularly dedicated producers," she says. Conversely, a show like "This American Life" has many producers whose overlapping roles involve research and development, recording in the field, editing tape, and scripting. Although a talk show-type podcast may not involve much editing, she says, a producer still does research and writes scripts and bullet points for the host.

Producers essentially "make things happen," ensuring needed steps are taken, Cohn says. Especially in podcasting, a producer "helps translate the idea for the ear because there's this misconception that all you have to do is walk into a room and turn on microphones and you can end up with a successful podcast," she says. Some hosts have this knack, she says, but it's rare. "It's helpful to have someone who is experienced with working for the ear to help translate those ideas so that as a listener, you have an intimate, engaging experience that will draw you back," she says.

Cohn's "working for the ear" experience includes being a musician and former member of the critically acclaimed and national touring band Cursive. Many people in podcasting come from musical backgrounds, she says, as "music teaches you to treat audio as a character and as a storytelling device. I was also very interested in storytelling and journalism and the idea of the interview. I think working in audio is the more direct way to explore all of those things."

Funny" for Howl, Cohn says, "they went to Buffalo and recorded themselves all weekend long and put together this amazing documentary that's really about their creative process. And that's not something you'd ever get to hear on their weekly show."

Podcasts are also attracting more professionally trained broadcast hosts into the space. "They see the freedom to create great content without the specter of a suit hanging over them or having to maintain that quarter-hour rating," Soderberg says. As more enter, overall quality will continue to rise, he says.

Better and more promotion is also occurring. NPR, for example, uses its popular "Invisibilia" podcast to crosspromote other NPR podcasts, similar to how television networks operate. Podcasters are looking to use feedback from iTunes, episode pages, tweets, emails, and other avenues to enhance listenership. Among the numerous discussion forums online where people are talking, Cohn says Reddit is a place where a lot of really interesting discussion is occurring. "A podcast isn't just a one-way device," she says. "It's a conversation with listeners. We like when our hosts call up a listener and ask a question or when a host plays a voicemail that he received from a listener. That adds to the conversation of whatever they're doing."

Webster says as metrics for gauging advertising success improve, dollars will flow in and more content will get developed. "It's less about educating people about what podcasts are and more about building a great show and promoting it," he says. "That takes money, and that's what it's going to take to break a podcast into being really a mainstream medium. And it's not far off now." As for how successful podcasts can become, Soderberg says, "I said it when I first started producing podcasts back in 2006. Talk radio as we know it is dead. Podcasts will become the main way people will consume spoken word audio content. When that will ultimately happen, that's the question I don't have an answer to. If I did, I'd be a very wealthy man at this point."



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Game Of The Month

Yeah, we know you have blogs to post, video to encode, reports to write, and code to compile. We do, too, but you have to take a break once in a while (and maybe blow some stuff up). That's why each month we give you the lowdown on what to expect from the latest interesting games.



Over the years, a handful of "masters of horror" have become household names. Everybody knows Stephen King, naturally, and most people will recognize Wes Craven, too. Your high school English teacher will probably mention Poe, while your *cool* high school English teacher quotes Lovecraft on command. With the release of SOMA, developer Frictional Games has more than earned a spot among this pantheon.

Frictional's curriculum vitae is short, but terrifying. The small Swedish developer first frightened gamers with the Penumbra series before scaring

the heebie jeebies out of everyone with Amnesia: The Dark Descent. Frictional then teamed with Dear Esther developer The Chinese Room to release a follow-up, Amnesia: A Machine For Pigs. Retaking full control of the reins, Frictional has unleashed SOMA, and trust us, this is a horror game unlike any you've likely played.

SOMA trades Amnesia's gothic nightmare for an underwater fear factory that feels a lot like what you would get if the 1997 sci-fi horror film "Event Horizon" took place in a research facility at the bottom of the Atlantic. Despite the dramatically different setting, SOMA feels and plays a lot like Amnesia, even if the former ditches the latter's health and sanity meters in favor of a more simplified approach. The PATHOS-II deep-sea lab has no shortage of monsters (although it isn't as jam-packed with horrifying abominations as you might think), and you have no weapons with which to fight back. So, you run. And hide. And cower. A lot. SOMA has this flavor of frightening down cold.

But let's face it: In 2015, a horror game needs a lot more than eldritch monstrosities and jump scares to be considered Game of the Month material. Where most horror games have an unswerving commitment to zigging, SOMA has the courage to zag, and the end result is something that feels as original as, if not better than, Amnesia. In SOMA, you will be confronted with a grotesquerie of humanoids, but they're not the main attraction. As the story unfolds, you'll find out that the "What are they?" and "Why are they here?" is far more important than the "Oh please, oh please, oh please don't let them find and vivisect me." The brand of terror that SOMA peddles isn't one of monsters and gore but rather the disquieting feeling of confronting the possibilities that technological breakthroughs could present for human mortality, consciousness, and existence.

Deep Blue Scream

BY VINCE COGLEY

\$29.99 (PC, PS4) • ESRB: (M)ature Frictional Games • somagame.com

There are occasions when SOMA feels a bit too much like a walking simulator. After the third time we had to trudge across the ocean floor to get to our destination, we began to wish Frictional had exercised a little economy in the environment. Every stage/level of SOMA presents a couple of light puzzles the player has to solve, but this ain't Portal. At the same time, though, the game's hand-holding is so minimal that it



would be fair to call it hand-neglecting. We won't blame you for turning to a walkthrough in order to calibrate a derelict radio antenna and just get on with the game already.

And we need to talk more about SOMA's monsters, because a lot of reviewers have denigrated them as irksome roadblocks that do little more than keep you from your appointed tasks. Regardless of the purpose they serve mechanically, the beasts of SOMA are absolutely vital to the story Frictional is trying to tell; SOMA is a different, inferior game without them.

Up to this point, we've said nothing of SOMA's protagonist, Simon Jarrett and what he's doing in PATHOS-II in the first place. It's no great spoiler to say that he's not supposed to be there, but the disturbing truth of *everything* else, including PATHOS-II and the Earth itself, is worth discovering for yourself. ■



Nearly three decades and numerous sequels and spin-off series after the first Might & Magic game, Ubisoft (which acquired the Might & Magic brand in 2003) has launched Might & Magic Heroes VII, a turn-based strategy RPG designed to also scratch players' itch for exploration and resource management.

The game's story revolves around the Duke of Griffin, a mighty warrior who has been unwillingly thrust into a position of leadership and is seeking counsel on how to proceed and stem the tide of war that is ravaging his world. This advice comes in the form of six campaign scenarios, as related to him by his advisors as they sit around a table in Griffin's stronghold. Each campaign draws on the mythology and unit types unique to the faction of the teller; you'll play as a necromancer, an elf lord, an orc leader, and so forth, and once you've completed at least two advisors' campaigns, you'll have access to Griffin's own scenario.

In each campaign, you'll begin with a couple hero characters and a town that serves as your base of operations. The campaign's map will largely be shrouded in the fog of war when you begin, and you'll need to outfit your heroes with armies made up of various troop types, drawing on your factions' core units as well as additional unit types that you unlock as you explore the map and take control of the numerous unit dwellings you encounter along with raw resources from mines, quarries, and the like.

You can also recruit additional heroes as you progress and have the resources to do so; this is important because each turn (which takes the form of one day in the game's timeline) consists of using up each of your heroes' individual movement and action limits for the day. So, the more heroes (and, therefore, armies) that you have in play, the more you can accomplish in a turn. As you take control of more resources, you generate more income per turn, which naturally means that you have the ability to raise bigger,



Epic Fantasy, One Turn At A Time

BY CHRIS TRUMBLE

\$49.99 (PC) • ESRB: (T)een
Ubisoft Entertainment • mmh7.ubi.com

more powerful armies for your heroes, and you'll need them because your opponents will be racing to do the same thing. An opponent with a resource advantage will likely also have a tactical advantage, and that leads to the primary draw of Heroes VII: the combat.

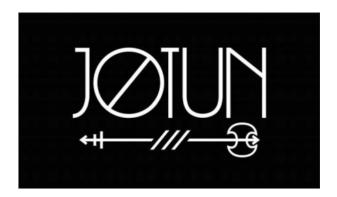
During the game, when your heroes encounter enemy heroes or advance to neutral resource points, in most cases a battle will ensue. (When encountering neutral forces, you will sometimes have the option of recruiting them and adding them to your strength.) Battles consist of a deployment phase, in which you must place your units according to their tactical strengths and weaknesses, and the combat phase, in which each unit on the board (including your hero) will have a turn to do their thing each round until one side bests the other.

Heroes VII's battles are really fun. Managing your ranged, melee, magic, and support units properly means being aware of their movement limits and abilities, as well as the capabilities of your enemy's units. You receive combat bonuses for flanking enemy units, coordinating your attacks, and so forth; there is an impressive amount of depth to the game's strategy.

Heroes VII hasn't fared well in user reviews and forums; we found numerous reports of technical problems, including game-crashing bugs in various game modes and corrupted save files, especially in the days immediately following its launch. We didn't experience any such issues, however, and Ubisoft is providing frequent updates. Aside from some decidedly retro visuals and cinematics, the only glaring issue we had with the game is that it lacks a tutorial mode, which would go a long way toward helping players unfamiliar with the franchise master all its disparate elements. As a result, beginners will likely find themselves restarting campaigns a time or two—and scrapping a substantial amount of play time in the process—as they learn how to be successful through trial and error.

Still, fans of the genre will enjoy many hours' worth of deep strategic combat in Might & Magic Heroes VII, which doesn't break any new ground but is pretty good at what it does just the same. ■





One of the things that makes indie games so attractive is the willingness some developers have to reject convention and strike out in bold, new directions. The results aren't always great, but they are often interesting, and every once in a while when a fresh approach to game design matches up with the talent to deliver top-shelf production values, you get something amazing. Such is the case with Jotun, a \$15 game we found on Steam that reminded us why we play games in the first place.

Jotun is the story of Thora, a Viking warrior who dies in a watery grave one night when her ship breaks apart in stormy seas and sinks. Thora's death fails to impress the gods, so instead of waking in Valhalla, she finds herself in purgatory, tasked with defeating several Jotun, giants that personify various aspects of nature, in an effort to gain entry to the glorious afterlife.

Jotun's gameplay is simple (although not always easy), and this is part of its appeal. The game evokes comparisons to old-school action RPGs such as The Legend of Zelda, in that you have a life meter, a couple of attacks, and, over time, a few special abilities. When the game begins, you have a short life meter and no specials, just your axe and your wits; you develop your character by visiting shrines to the gods and receiving their gifts. The world of Jotun is vivid, colorful, and fun to traverse, and it requires you to solve a number of puzzles in order to fully develop Thora's abilities and face off against the Jotun.

As you can probably guess, the enormous, menacing Jotun are the bosses for their respective areas, and each one has its own fight mechanics. These battles are challenging and fun, and each one provides



Gaming Valhalla

BY CHRIS TRUMBLE

\$14.99 (PC) • ESRB: Not Rated Thunder Lotus Games • jotungame.com

a satisfying ending to its portion of the game. Upon completion of an area, you can either stick around and explore some more, in case there are items that you haven't yet found, or you can head to purgatory's nexus and choose which area to enter next.

The first thing that strikes you when you fire up this game is how beautiful it is. The dev team at Thunder Lotus talked a lot about how important this was during the game's Kickstarter (which raised \$64,000 and change in 30 days during summer 2014), and the team very clearly delivered. Jotun's hand-drawn 2D world is full of verdant forests, desolate snowy peaks, mysterious caverns, and more, and every new area begs you to explore it. The game's sound adds to the ambience; the music throughout is haunting and beautiful, and when combined with the Icelandic narration that tells Thora's story, is highly effective in setting the mood.

We love everything about this game. It looks and sounds incredible, it's a ton of fun to play, and it has a cool story and a character that is a breath of fresh air. All things considered, you would be hard-pressed to find a better way to spend \$15. ■







For us, when the first paid DLC for CD Projekt RED's massive fantasy RPG The Witcher 3: Wild Hunt launched, it was a bit like being served a surprise second dessert halfway through a sumptuous 17-course meal. In our initial review of The Wild Hunt, we said that the game's strong narrative and an impressive quest backlog would have us plumbing its depth for a very long time, and now, five months and 60 or more hours later, we're still engrossed in the world and intent on exploring its every nook and cranny.

The only difficult thing to swallow about Hearts Of Stone (\$9.99) is the fact that Geralt must be level 30 to begin this ride, which is roughly where you'll be when you complete the main game, potentially a hundred or more hours after you first strap in.

Thankfully, CD Projekt RED doesn't expect everyone to be there (we weren't) and gives you the option of adding Hearts Of Stone's first quest to your current log so you can plunge in when you hit level 30. Alternatively, you can jump in right away with a level 30 version of Geralt complete with the corresponding number of skill points ready to be spent on all your favorite upgrades. We chose this latter option, yet felt a little like we were punching above our weight throughout the expansion's tougher battles because of Geralt's modest gear. There are some bosses in the expansion—one particularly menacing figure wielding a shovel in a mist-filled garden comes to mind—that were

just plain tough, forcing us to abandon the button mashing in favor of a more cautious approach.

There are a handful of new enemies in Hearts Of Stone, two notice boards full of side quests, more than two dozen hidden treasures to discover, numerous abandoned sites, bandit camps, dungeons, herbalists, merchants, new Gwent cards to collect, and the new realm No Man's Land as well as an expanded Oxenfurt to explore. The Runewright is a new kind of merchant who grants the ability to enchant armor and weapons with Runewords. The

Careful What You Wish For, Unless You Wish For More Witcher 3

BY ANDREW LEIBMAN

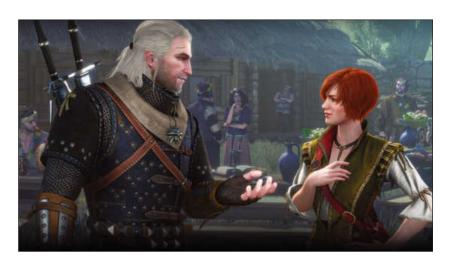
\$9.99 (PC, XOne, PS4) • ESRB: (M)ature CD Projekt RED • www.cdprojektred.com

Preservation Runeword, for instance, lets you maintain armorer's table and grindstone bonuses indefinitely.

The real meat of this 10- to 15-hour expansion is in the new story missions, which focus on the immortal bandit captain Olgierd von Everec and his uneasy pact with the deadly and otherworldly Gaunter O'Dimm, Master Of Mirrors and Man Of Glass. Both need Geralt's help to defeat the other, and in the process, Geralt is tasked with accomplishing three seemingly impossible quests. You'll also happen upon a fire-haired Shani, a healer from the first Witcher game with whom Geralt has a history, and you'll have a chance to rekindle the flame.

Of the three primary missions, the one in which Geralt lets a boorish spirit inhabit his body at a wedding is the most fun, and unravelling the mystery of Olgierd's troubled home life is the most poignant. The middle-chapter heist mission is the weakest of the three, but that's like saying the chocolate lava cake isn't as good as the tiramisu or the caramel mocha cheesecake.

With The Witcher 3, CD Projekt RED set the bar for story-driven gameplay in a modern RPG, but with Hearts Of Stone, it raises the bar. Buy this expansion, even if you need to plow through a significant portion of The Witcher 3 before you can fully appreciate it. It's well worth the wait.



Q&A With Sean Smillie

The Art Of Writing For Videoga

As the landing page for the University of British Columbia's Game Writing Academy reads, "Even games with the most cuttingedge graphics and action will fail to deliver if the characters and storylines are not compelling." Enter the videogame writer, a vital component in helping create the dialogue, narrative, backstory, lore, character biographies, and other aspects of a videogame that give it dimension and flavor.

How does one become a videogame writer? Sean Smillie, a 15-year game industry veteran, developed the Game Writing Academy—a six-course online program launched last summer—to help would-be game writers answer that question. Through the courses, Smillie provides students an insider's perspective on the game writing and production processes and provides guidance for creating a portfolio to pitch to gaming studios. Smillie has logged time at EA (Electronic Arts), Ubisoft, Disney, and Popcap Games as a writer, producer, creative producer, and senior game designer and worked on such titles as SSX 3 and SSX 4, Deadly Descents, Marvel Nemesis, Need for Speed: Undercover, and Hidden Agenda. We spoke with Smillie about the academy, the game writing experience, and a writer's responsibilities to game development.

: What was the impetus for the Game Writing Academy? What thought process and philosophy went into its development?

CC: It started off with a really simple meeting between UBC (University of British Columbia), myself, and a few other writers who work in other fields. Sort of like a panel discussion about writing and multiple mediums. And it started a discussion about videogames and the opportunities there for some sort of writing course or a course that would also include creative process and insight into the gaming industry. It just kind of snowballed from there. I have a great partner at UBC, and between the two of us we developed the idea for the courses. It became a lot bigger than I thought, which is fantastic.

: In what way?

: Originally I thought it was just Ogoing to be a couple of courses, sort of game narrative and maybe some dialogue writing, but the more time I spent working with UBC and looking at it, we broke it out into six courses. It covers quite a range of aspects of the creative aspect part of games. I really



realized there was more than enough material to fill each course, like insights on how the industry works, the process a team would go through, a writer's place in it all, and all kinds of different aspects of writing that's included in a game.

: There's a lot of diversity in the courses you're offering. Why should someone take these courses?

SS: Well, funny enough, the reason is quite diverse. Years ago when

I started working in games as a writer, I sort of found myself jumping around from department to department within a game-writing dialogue, creating character backstories, working on the plot, writing out cinematics, and sort of taking part in building out the concepts or world-building. So those are parts of my past experience, all the aspects a writer might have the opportunity to work in, and what I ended up doing throughout my career. So I thought it would be great to offer multiple courses that touch on everything and sort of dive into it.

: Do people generally realize how many types of writing are involved with game writing, including writing user manuals, marketing material, website info, etc.?

🗨 🕻 : No. I've been really fortunate that I've been able to go to really big conventions like Comic-Con or PAX or big events where video players and fans would end up, and you end up talking to people and realizing the game industry is kind of closed off to the public. People know a game takes a while to make, and there's a bunch of people who do animation, programming, and design, but I started to realize a lot of people don't know all the different moving parts of a game's production, so I decided this was an awesome opportunity to show people the details of how a game is built and where their position could be in it. And there's tons of opportunity in there.

: Some people have the idea that game writing is a one-man operation, but it can be very team-oriented, right?

SS: One of the challenges I had in the course was explaining to people that a lot of this is guidelines. It's basic philosophy. It's sort of the process because each team and each game is different. I've worked on a game where I was the only writer, but then I've worked

projects that had multiple writers on it that you have to collaborate with. Some games today have 30,000 lines of dialogue. That's a lot for one person to write. Or an hour's worth of cinematics or 20 characters. That's a lot of work for one person.

: What types of collaboration and relationships might a writer have to work within and forge, including with designers, artists, and others?

S: That's something I really stress in the course. My No. 1 partner in games has always been a concept artist. I would write out the character or scenarios or environments. I'd write down what the environment in the world

My No. 1 partner in games has always been a concept artist. I would write out the character or scenarios or environments. I'd write down what the environment in the world would have to be like, and then that has to be visualized.

on a game where there was a room full of writers. It was a lot like a television series. There was a whole room of writers, and we worked together. It really depends on the game. I've found in the early days (early 2000s), it was just one writer, maybe two, and then probably just on contract. But over the years, I've worked on a lot of

would have to be like, and then that has to be visualized so the team knows what it is building and has a target to go after. Usually I would sit at my desk and right away hand over the pages to a concept artist, and he would start sketching ideas. Then an art director would jump in, and then we'd show it to character modelers.

So, yeah, you may work by yourself for a bit, but you're always handing stuff over. You're always collaborating with people. You're always working on iterations together. A lot of people think, "Oh, you're just a writer. You're sitting by yourself working away." But actually a big part of the job is collaborating with others, taking feedback, and working together to create something, which is really fun. I'm a terrible artist, so it's great when amazingly talented artists are bringing my words to life.

How important is it for someone who writes for games to be a gamer? Can you write effectively if you're not?

SS: Well, from experience, I've worked with writers from film and television and comics who didn't play games. I found there were a lot of challenges there. They ended up always trying to design the game instead of writing the story. One example is one writer I worked with handed over 100 pages, and it was 90 pages of story and 10 pages of action. I had to tell him that actually it needs to be 10 pages of story and 90 pages of action because that's a video game. I always push on writers that if you want to work in games, play games. At a minimum, go on some sites and review games, read about how some games are made, read some reviews, and kind of get an idea. Most people wouldn't write a movie without ever seeing a movie. But people do, and I always try to encourage people, "Know your subject matter. Know the medium you're working in."

: How are writers viewed within the gaming industry? Do they get the credit they deserve?

S: I think that's something we share with writers in the film industry. More and more writers are starting to get recognized for their work in games, which is great, but not really. I think there are a couple reasons. One is that a game is a massively collaborative experience. There are game designers, art directors,

tech directors, animators, and modelers. People contribute so much to a game; it's never just one person. Even when it comes to a concept, it's never just one person's idea. It's usually a studio's idea or multiple people's ideas. But I have noticed more and more writers are getting called out for their work and their ideas. I think that's great.

: In movies, certain writers do gain a following, someone like Tarantino for his dialogue, for example. Is it difficult for a game writer's taste or personality to come through to the point it's identifiable to gamers?

SS: I'm not sure if that would happen for writers. I think it's starting to happen for certain game designers. There are certain game designers out there now where it's like, "Oh, it's one of the guys from Halo or Gears of War or Mario or something," and people will buy that game because it's a certain game designer. But it's not prominent, and a lot of that has to do with game companies. When they advertise a game, they really advertise and promote the game, and rarely do they promote anyone associated with it. Hollywood tends to say it's a Spielberg film or an Aaron Sorkin script or the actor. Whereas in games, it doesn't tend to be so much about the people. It tends to be about the game, which is good I think. But games are much bigger than Hollywood, and I find it funny we don't have the recognizable household names that Hollywood does.

: What are a writer's responsibilities to a game? What purpose does she serve?

CC: The big one I'd say right off Othe bat is their work has to complement the gameplay, the game design. You're writing in an interactive experience, an immersive experience for the player, so you can't write in a bubble. You have to know what's going on in the game, understand that gameplay drives all, and you have to sort of marry your work to it. I've been guilty of this in the past, sitting down writing a concept and

forgetting, "Oh, this is a game. Somebody is going to have to experience this over 20 hours. I'm going to have to restructure my work so that it's fresh, so it has good pacing, and that it complements the pace of the gameplay." And that's where the challenges come in writing for a game.

: What are other challenges or difficult aspects of the game writing process?

SS: The first one I've always found personally is that games can take a long time to make. I've worked on games that took two or three years to make. That's a long time to be focused on the creative side. No. 2, you're sort of held hostage, which is kind of good thing, by the production. What engine are we going to use? What's the capacity for environments and characters? The first thing that usually gets beaten up, cut, twisted, and has to be adjusted is the creative. Once you start working with an engine or figuring out a dialogue matrix or an animation tree, they're not going to turn around and scrap all that. What they'll usually do is turn around and scrap the story or ask for a rewrite.

: How does someone start writing for games? The academy is a great resource, but is there a typical path writers have traditionally followed in terms of education and gaining experience?

SS: It's from all different avenues. One thing I'm trying to put out with these courses is that this program will help you sort out your own process. It will educate you on how to work your work to get it into the right hands and be aware of how development and production work. People end up getting into writing in games by writing in other mediums. Some just apply and show a portfolio. I know a ton of writers in games, and nobody has the same story of how they got in. One thing I'd say, for a writer to get into games they have to write. They have to show writing. They can't just show up and say, "I love games and I have great ideas." They have to be

able to show a portfolio of their work. You have to show you can write. A lot of people always seem surprised by that.

: What do you envision long-term I for the Game Writing Academy?

SS: My biggest enemy has just been time. It took me nine, 10 months to develop all these courses. I wrote all the material. I put my own concepts into the courses for students to work off. I opened it up for them to create their own concepts. It's actually taken a long time to develop these courses. What I see for the future, I just reached out to the game industry, predominantly in Vancouver and Montreal, and I put the word out saying, "I'm going to send out a 20-question Q&A document. I'm reaching out to art directors, writers, producers, animators, concept artists—everyone. I want you to fill this document out, and it's all about your career, the challenges, all the advice you can give in 20 questions." And I got a massive response from friends I've worked with. And that's something I'm going to start including in the courses in the spring. I'm going to start including those interviews scattered throughout the courses.

The next stage, I have a really good network, so I'm reaching out to friends and saying, "Hey, I'm going to interview you on video for a half hour and embed them into the courses." I'm going to reach out to studios and say, "When this course finishes, I want to have a pipeline to your studio to submit portfolios." Those are the things I plan to bring in, and I plan to bring in not guest lecturers, but guest artists who will write up an essay about a particular area of the game. The interesting thing is every single person I've talked to about it is totally in. It's just about the time and gathering all that together. That's where I see the program evolving. It's starting to pull in more and more perspective from the game industry and trying to make connections with studios so that there's a direct path for people to get their portfolios reviewed.

Look For CPU At These LAN Parties

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PDXLAN Charity Event Portland, OR

pdxlan.net

11.07-08-15

Catacombz 22 Eldorado, IL

www.catacombz.com

11.13-14-15

West Dining Center LAN 2015 Corvallis, OR

www.lanreg.org/osugaming /west2015

11.13-15-15

LANFest Austin Fall 2015 Austin, TX

lanfest.intel.com

11.13-15-15

LANFest Great Escape LAN - V Sacramento, CA

lanfest.intel.com

11.20-22-15

WasteLAN

Menomonie, WI

pong.uwstout.edu

11.21.15

Oklahoma Gamers Group Oklahoma City, OK

www.okgg.org

11.21-22-15

San Diego Rocket League 3v3 San Diego, CA

SanDiegoLAN.net

11.21.15

Willamette Valley Gamers LAN Eugene, OR

www.wvgamers.com

11.28-29.15

LANified! 24:

Rumble in the Rift

Calgary, AB

www.lanified.com

11.28.15

The Promised LAN Prattville, AL

www.thepromisedlan.weebly.com

12.19.15

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Oklahoma City, OK

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LANFest MLP'016 Winter Hamburg, NY

lanfest.intel.com



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www.fadecon.org

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PAX

South

San Antonio, TX

www.paxsite.com

02.12-14.16

Forever-A-LAN

Menomonie, WI

pong.uwstout.edu

02.18-21.16

PDXLAN 27

Portland, OR

pdxlan.net

02.19-21.16

BoiseLAN 2.0

Boise, ID

www.boiselan.net

02.20.16

Oklahoma Gamers Group

Oklahoma City, OK

www.okgg.org

03.19.16

Oklahoma Gamers Group Oklahoma City, OK

www.okgg.org

03.25-27.16

Easter LAN

Menomonie, WI

pong.uwstout.edu

04.09-10.16

Nexus LAN 17

Miamisburg, OH

www.nexuslan.org

04.15-17.16

Maryland

LAN Gamers

Greenbelt, MD

www.marylandlangamers.net

04.15-17.16

VectorLAN 7

Portland, OR

pdxlan.net

04.16.16

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Q&A With Derick Magnusen

K USA's Mar

: EKWB recently launched its EK-XLC Predator all-in-one CPU liquidcooling solutions; can you talk about what sets Predator apart from other all-in-one coolers on the market today?

1 : Predator is meant to blur the lines between the now classic CLC/AIO and a custom loop. The biggest differences between Predator and the competition are the ability to easily expand the unit and that the radiator is completely copper so you don't have to worry about corrosion. We understand that sometimes jumping into a fully custom loop can be very overwhelming for someone who has never watercooled before; Predator works right out of the box and doesn't require any assembly of the loop. This way customers can take things at their own pace and allow themselves to get comfortable with the idea of a custom loop. When they feel the need to watercool their GPU(s) or go full custom, the Predator will be ready for them-expanding the Predator does not void a customer's warranty.

: Your product page says the Predator has "exceptional build quality." Can you elaborate on that?

: EK has always been about quality, and we wanted that to be continued with the Predator series. The Predator core components are identical to those that customers would buy to use in their custom loop. We utilize our awardwinning Supremacy MX waterblock, a special low-voltage Laing DDC pump for the best efficiency, our in-house Vardar series of static pressure optimized fans, standard 10/16mm (3/8" ID 5/8" OD) compression fittings and tubing, and most importantly,



we use a full copper-core radiator. So far the most consistent feedback that we've received from reviewers and customers alike is the outstanding quality of the unit.

: For readers who aren't familiar with them, what are the benefits of the Predator 360's Quick Disconnects?

: Quick Disconnects allow for a customer to make a "break" in the loop without having to drain the entire loop. This allows people to add or swap in additional components without having to get their hands wet. The Predator 360 features CPC medical-grade Quick Disconnects that don't spill a single drop when utilized. The primary purpose of these will be for customers to add in a prefilled GPU block when they're ready. This is a never-beforeseen feature in the CLC/AIO market that will allow customers to watercool their CPU and GPU without having to have any interaction with the coolant inside.

: We really like the idea of taking the pump off of the waterblock and putting it on the end of the radiator. Did it take a while to get this design to work spatially, or will the Predator play nice with most cases that support double rads?

: Most cases that support 240 radiators will support Predator, but we are currently building a database of cases for customers to check. The list will be generated with assistance from customers and feature photos of the units installed in their respective cases. If customers do not see their case on the list, we recommend checking out the official dimensions posted on our website. If they cannot determine if Predator will fit from the provided dimensions, they should head over to our official forums on Overclock.net for assistance.

: Speaking of waterblocks, are EK's pre-filled, QDC-enabled GPU blocks available now, and if not, when can readers expect to see them in your Web store?

: The prefilled QDC-enabled GPU blocks will actually be available Nov. 5. The hardest decision that came with this accessory was choosing which blocks we wanted to make QDCenabled, since we offer so many types of blocks as it is. We ultimately decided we will offer an upgrade service for every single block that we sell. When selecting a block from our store (shop.ekwb .com), there will be a drop-down menu that allows the customer to specify if he wants it prefilled and capped with QDCs or standard. This will allow customers with virtually any GPU on the market to have access to this feature. Customers will need to check out



EKWB's EK-XLC Predator 360

from our store to utilize this service. Our network of global partners will also offer prefilled GPU blocks with QDCs, but which ones they stock will be up to them.

EK has been a major force in cooling for lots of years, and all-in-one coolers have obviously been a big deal in the DIY community for several years. Why did EK wait so long to develop its own AIO, and what made now the right time?

DM: Predator has been in development for quite some time now, and because of our reputation in the DIY market, we knew that if we were to release an AIO it had to be perfect, so we kept working on it until we felt it was up to EK standards. In the past year we've had the opportunity to visit tech shows around the globe and interact with both current customers and customers who were interested in liquid cooling but weren't ready for a custom loop. After all the feedback we received, we knew that now was the time to unleash the Predator.

: Your site mentions EK-Vardar fans and Laing DDC pump as major additions to the cooler. What advantages do these items bring to the table?

DM: Our Vardar series of fans were developed in-house and are optimized for static pressure, offering the best performance possible when paired with

liquid cooling. The Vardar fans used with Predator fall under our line of Extended Range or ER fans, which allow users to adjust the fans to anywhere between 25% and 100% via the PWM settings of their motherboard. Silence has always been sold as a benefit of liquid cooling, but there haven't been any great fans that can be dialed down as low as the Vardars can via PWM, while maintaining performance.

Compared to standard CLC/AIO pumps, the Laing DDC is an incredibly powerful pump that many use in their custom loops. The version that powers the Predator is a low-wattage version that runs much quieter. Our recommended limits on what the pump can handle is one CPU, two GPUs, and two radiators.

: EK custom cooling setups are known for having clear tubing and colorful coolant, and of course the Predator (like most all-in-one coolers) has opaque black tubing. Was there any discussion of going with clear tubing, or did you rule that out immediately, and why?

DM: Unfortunately the problem with clear plastic tubing is that coolant can actually evaporate through it. It's very slow, but it is possible. Although the Predator is easily expandable, at its core it is an AIO, and if we decided to go with clear tubing, customers would eventually have to add coolant to their units, and that's not what we

wanted. The expectations of most customers is that they won't ever have to touch their unit once it's installed, and they shouldn't have to because it is an AIO. Luckily we already manufacture a special kind of rubber tubing dubbed Zero Maintenance Tubing, or ZMT, so ultimately we chose to go with black opaque tubing.

Q: What is Hovercore technology, and what does it do?

DM: Hovercore technology is the isolation of the pump and radiator units that significantly reduces the vibrations from the pump. With a normal AIO, the pump can transfer its vibrations to the motherboard and then to the case, creating noise. Hovercore technology allows the Predator to keep vibrations to an absolute minimum and in general keep your computer much quieter.

Q: What would you say is the Predator's best feature, and why?

DM: That's a hard one, but if I had to choose I would say that the expandability is the best feature. One of the most frustrating parts of upgrading is having to sell your old gear. Chances are it's devalued quite a bit, especially cooling gear, and the whole process of finding a buyer, and hoping one of the shipping couriers doesn't break it once you do find a buyer, is all very tiresome. The Predator is one of the first products in this field to truly be future-proof, and we're very excited about that.

: Is there anything else you'd like readers to know about EK's Predator all-in-one CPU coolers?

DM: If anyone has any questions, feel free to contact us on our official forums at goo.gl/GpFous. Myself, our support team, and even the engineer who designed the Predator are there at least once a day and would love to answer any questions you may have. We're very excited about the launch of the units and look forward to seeing our customers again during any of the LANs or tech shows of 2016!

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